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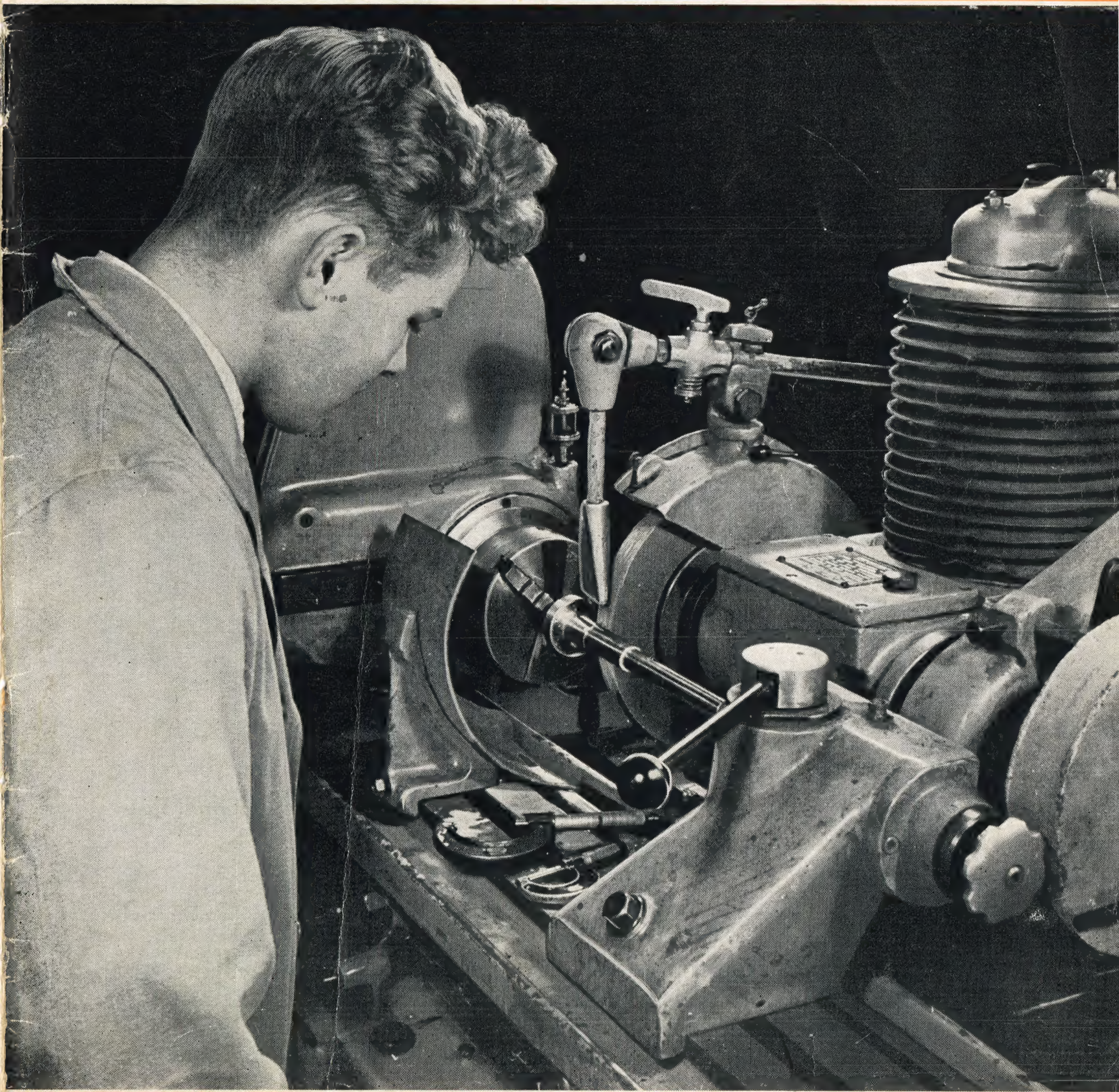
Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED



ONE SHILLING 16 MAY 1957 VOL 116 NO 2921

Model Engineer

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To good account: How a knowledge of model engineering helped to build a yacht

Scale dock shunter

All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W.1.

Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

THERE are those who look on the paddle steamer as a primitive sort of steamship, a survivor of the Victorian Age. This is far from being the case. Where extra manoeuvrability is required the paddler has much to recommend it, especially when the paddles can be used independently and can rotate in opposite directions.

Harbour tugs and passenger steamers operating in shallow estuaries are still occasionally operated by paddles, and a number of such vessels have been built in recent years. Even within the past few weeks the Admiralty has taken delivery of two paddle tugs, *Director* and *Dextrous*, and five others are being built.

These are of 710 tons, with a length of 157 ft and have a speed of 13 knots. The power unit is diesel-electric and they have twin funnels placed side by side. Experience has proved that paddle-driven tugs are most suitable for handling large ships in docks and confined waters.

Philadelphia meet

KENNETH SOUSER'S farm near Philadelphia—and how lovely the Pennsylvania farms are at this time of year !—is going to be a busy place on June 8 and 9.

The Pennsylvania Live Steamers have their club track at the farm, which is located at Darby and Buttonwood Roads, Paoli, and the second weekend in June is the occasion of their annual live steam meet. Running and steaming-up facilities are provided for on $2\frac{1}{2}$ in., $3\frac{1}{2}$ in. and $4\frac{3}{4}$ in. gauges. The track is laid on ground level.

J. Harold Geissel of Paoli, chairman of the Meet Committee, tells me that rough grading for a 1,100 ft extension to the existing 660 ft loop is about finished, but as it involves bridge building at a two-level crossing it will not be ready for use at the meet. Never mind: the track as it stands will make everyone happy—especially if Pennsylvania has one of its glorious Junes.

All live steamers and their engines (finished or unfinished) are invited. Mr. Geissel gives his address as Registered Architect, Paoli, Pennsylvania, and I am sure that this will find him. Paoli has a population of 3,000 and everyone knows of it because it stands on the mainline west. Philadelphia people speak of the "Paoli Line."

There could scarcely be a more appropriate place for a live-steam meet.

The last Star

ONE of the most outstanding classes of British steam locomotives was Churchward's famous Star class for the Great Western Railway.

They were four-cylinder express passenger engines of virtually a new type. Nothing quite like them had been seen before when the first example, a 4-4-2 engine, No 40, was

Smoke rings . . .

completed and put into traffic in April 1906.

In the following year, ten very similar engines, but with the 4-6-0 wheel arrangement, were built; and then at intervals up to 1923, 62 more, with more or less minor modifications, brought the total number up to 73.

For nearly a quarter of a century, these engines were the mainstay of the G.W.R. Their performances were not only prodigious, but were far ahead of those of comparable engines, and they stand out today as an epic in the annals of British locomotive history. But now their day is done; by the withdrawal last March of No 4061 *Glastonbury Abbey* only one, No 4065 *Princess Margaret*, is left on the active list. Be it noted that this engine is *still* on express passenger work.

The fame of this class, however, has a lasting memorial in No 4003 *Lode Star*, which is preserved at Swindon.

W.R. diesel railcars

THERE was some excitement at Reading one recent morning when one of the motor coaches of a Western Region diesel train set was found to be on fire. Fortunately, nobody was hurt, but the local fire brigade had to be called to deal with the outbreak and caused some considerable delay to other traffic because hoses had to be laid across adjoining tracks.

The Western Region diesel railcars have been unfortunate with regard to fire, about half a dozen of them having suffered in this way. They were introduced in 1934, and a total of 38 were built, in batches embodying certain improvements, until 1942. Two of them, however, were designed and built for parcels traffic only.

It is understood that these railcars are to be gradually withdrawn from service later this year and they will be replaced by a number of the latest type of lightweight diesel trains which have become so popular with local passengers in other regions of British Railways.

Waterway signals

A NEW use for railway signals has been found by the British Transport Commission. Craft entering the Saltersford Locks, near Northwich, Cheshire, are now controlled by standard railway signals which were obtained through the London Midland Region stores at Euston.

Previously, signals during daylight were given by hand and in poor visibility there were occasional misunderstandings. These have been overcome by the semaphore arm signals which give well defined directives by day or night.

The locks are on the Commission's Weaver Navigation in the North Western Division of British Transport Waterways.

Ton of tyre

IMAGINE, if you can, a tyre weighing a ton! It has a diameter of 7ft 5 in., is 2 ft 5 in. wide across the tread, can carry 20 tons, and contains 300 miles of nylon cord—not to mention close on two miles (2,910 yards) of bead wire.

The Lord Mayor of Birmingham, Alderman E. W. Apps, does not need to imagine this monster. It was he, at Fort Dunlop, who released the tyre from its mould. The mould itself weighs 18 tons and the overhead crane used to move the barrel of the curing chamber has a 30-ton carrying capacity.

The tyre is in full production for opencast coal mining, dam projects, building sites and civil engineering in general. As well as saving dollars —perhaps as much as 180,000 dollars a year—it will earn money overseas in countries where there are big development schemes. Many of the huge earthmover machines at work in Britain are of American origin and have had to be fitted with American tyres.

Cover picture

A young lad at work on a modern lathe equipped with an electronically controlled head. Under the educational scheme in Essex teenage boys can take a one or two year pre-technical course in a modern workshop.

What—no steam?

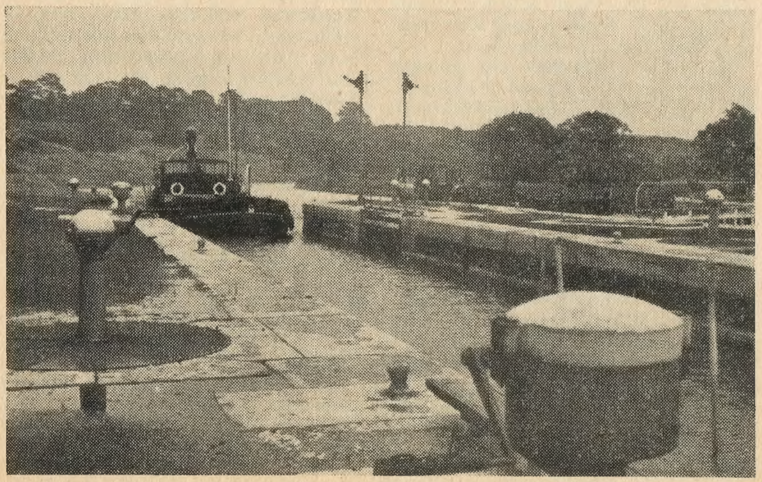
MOST people have heard the ancient joke about the train which stopped on a clear section of line because "the engine had gone off the boil"—but few would believe that it could happen nowadays, and to one of Britain's premier expresses, at that. According to newspaper reports, however, the *Golden Arrow* was recently delayed for that very reason; it is stated that "the driver and fireman worked frantically to restore the steam pressure!"

Assuming that the occurrence has been correctly reported, it suggests that the standards of competence and pride-of-craft of locomotive crews have fallen off badly, but it is possible that circumstances outside their control were responsible for the trouble.

Loss of steam pressure may be caused by poor quality coal, or impure water which causes furring up of heating surfaces in the boiler. There have been occasions when difficulties in traffic organisation have resulted in an engine of inadequate power being given the task of hauling a heavily loaded train.

Unless and until all the facts connected with it are available, it would be indiscreet to jump to conclusions. But I know that many readers in the "live steam" fraternity would consider it a grave dishonour to allow their locomotives to peter out from lack of steam!

The locks on the Weaver Navigation, in the Western Division of British Transport Waterways, which are operated by standard railway signals



A new horizontal marine engine

Why always a *vertical* engine, asks H. J. TURPIN. With care, this unit will give extremely good—and long—service

I HAVE often wondered why almost every steam-driven model boat is fitted with a vertical engine, for with this type of engine space has to be provided for its upper end in the deck cabin or some kind of keel weight has to be added.

The main object of this horizontal design, which was originally introduced for the boat section of Enfield and District M.E.S., is to maintain a very low centre of gravity. Two other points: the propeller drive can be taken off in a forward or rearward direction and separate piston valves are provided for steam and exhaust.

In my original model it was found that at low speeds and low boiler pressure the rotary motion was a little irregular owing to the small outside diameter of the flywheel—1½ in. This has since been enlarged to 1¾ in. and is now very satisfactory.

This horizontal engine is suitable for boats up to 40 in. and a propeller up to 2½ in. dia. of normal pitch. But I must emphasise that first class work must go into this engine if first class performance is to be achieved; particular attention must be paid to the piston valves, valve setting, flywheel and bevel-drive unit.

DUAL VALVE CHAMBERS

As the procedure for machining cylinders, pistons and piston rods has often been given in this journal, all that need be mentioned here are the dual valve chambers. The steam ports are circular holes, No 36 dia., drilled at ⅝ in. centres—and the position of where they enter the valve chamber is important, as it affects the valve timing; likewise the lengths 13/32 in. and 31/64 in. on the piston valves.

The valves are 5/16 in. dia. and both these and the holes in the cylinder should be lapped smooth, parallel and round.

How tight should the valves fit the holes? Well, a good test is to clean and dry thoroughly all the surfaces of both components, hold the cylinder with the valve chambers vertical and assemble the valves so that a light touch will allow gravity to draw them through.

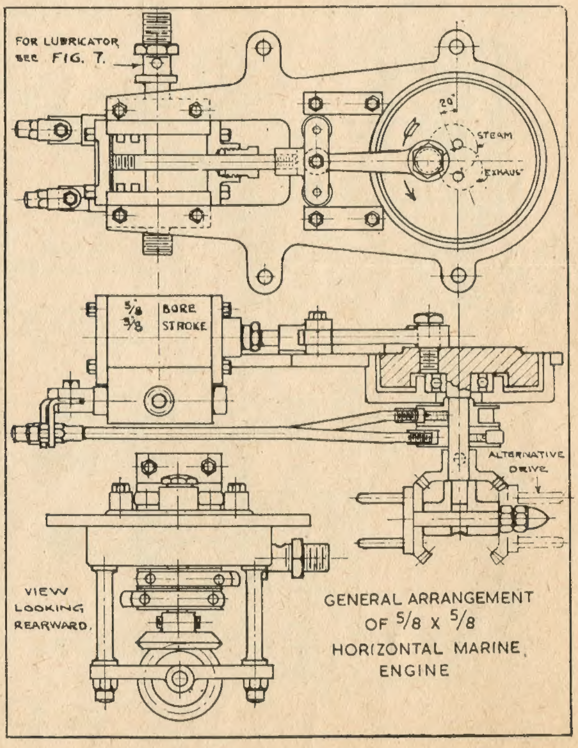
THE ECCENTRICS

As the flywheel shaft is vertical the weight of the eccentric sheaves is taken on the lower flanges of each eccentric. That is why ample area is provided by the 15/16 in. dia. to keep the valve rod square and steady. Note that the amounts of eccentricity are different for steam and exhaust.

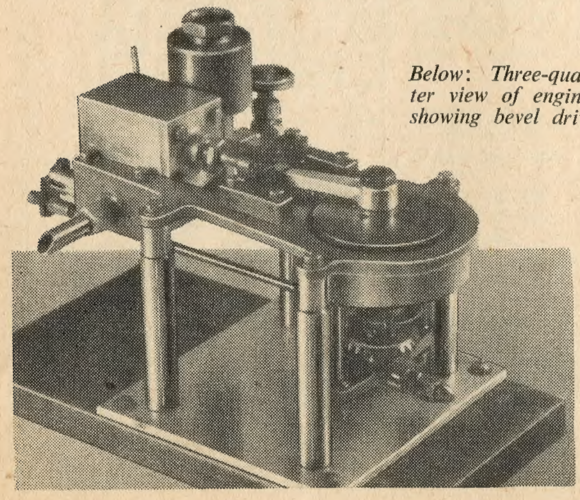
The drawing calls for surface hardening, but this should not be until the valve system has been assembled and found correct. The proper setting for the eccentrics is shown in the general arrangement drawing (Fig. 1).

On the prototype the valve rods are made of ⅛ in. dia. welding rod and are quite satisfactory. Particular care

Right: Assembly: note the separately adjustable valves



Below: Three-quarter view of engine, showing bevel drive



Marine engine . . .

should be taken with their shape. The angle piece at the valve end should be clamped firmly between the two No 5 B.A. nuts, but the connection to the valve should be free throughout the length of the stroke.

FLYWHEEL

The flywheel is designed so that it can be turned all over at one setting in the lathe. The shaft could be pressed into the flywheel proper, but I feel that the one-piece method is more straightforward and quicker in the long run. Besides it ensures absolute alignment. The two No 36 holes on top are for the removal of the $\frac{1}{4}$ in. dia. ball race.

The engine frame is constructed from two members—the baseplate cut from $\frac{1}{8}$ in. brass plate and a plain cylindrical member which registers with the plate by the $2\frac{1}{16}$ in. dia. spigot. This joint is soft-soldered to form one complete unit.

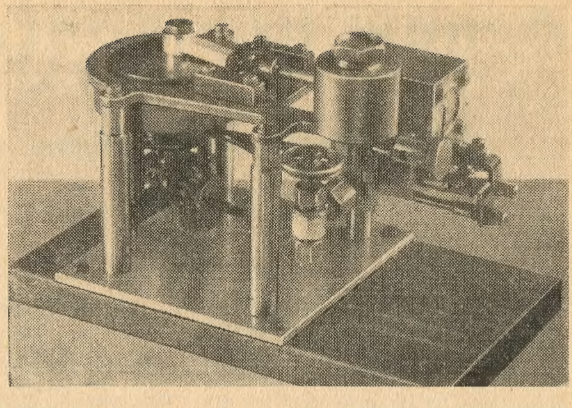
PROPELLER DRIVE

Two Meccano bevels are used to transmit the drive from the flywheel shaft to the drive shaft. These bevels have to be modified (see Figs 4 and 5), each to suit the relevant shaft. The drive shaft has its bearing in a bracket which is mounted on two pillars screwed into the underside of the cylindrical member of the baseplate—and can be assembled so that the drive can be directed either forward or rearward.

The lubricator is a variation of the well-known displacement type. The oil delivery hole, No 72, is drilled in the top of a piece of 5/32 in. hexagon brass screwed No 3 B.A. into the bottom lug; it is assembled and removed with the aid of a 5/32 in. hexagon box spanner. Finally, the bottom lug with a $\frac{5}{16}$ in. dia. hole should be made really parallel when assembled on the steam inlet pipe on the cylinder (Fig. 3) so that the lubricator is firmly held and the joint remains steamtight. A smear of gold size will be particularly useful here.

The photographs show the engine on a demonstration stand. In a boat the engine would be secured to its mounting by the four lugs on the baseplate. ■

Cylinder and lubricator end of engine



Below, left and right: Details of the cylinder unit

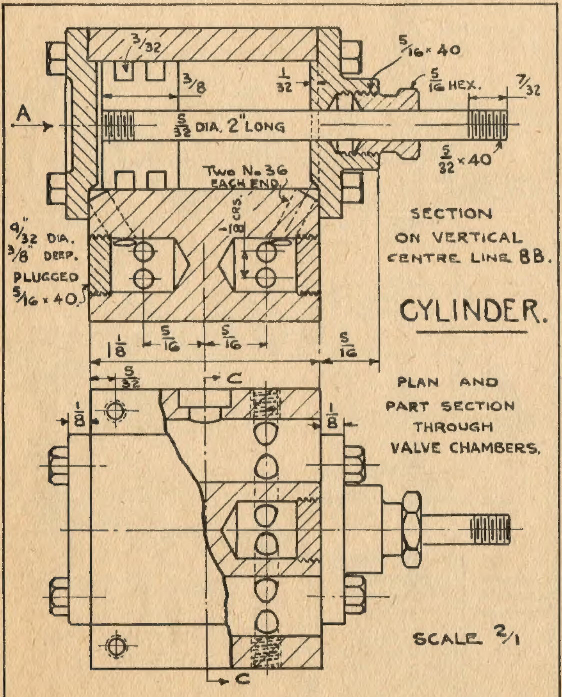


FIG. 2.

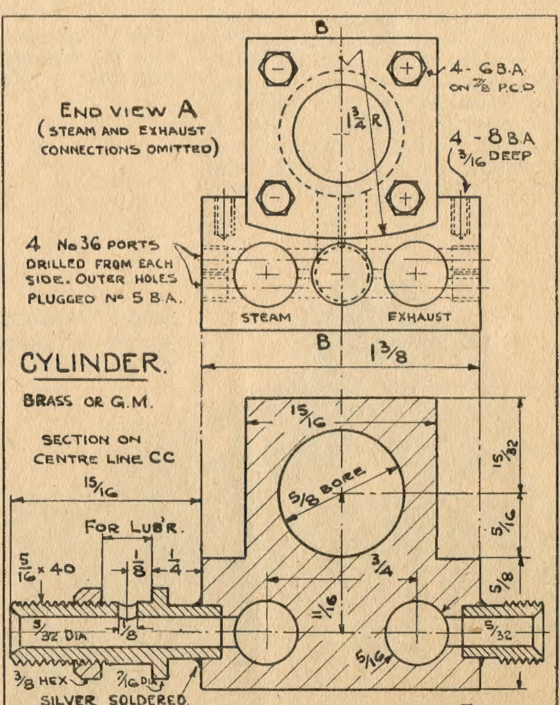


FIG. 3.

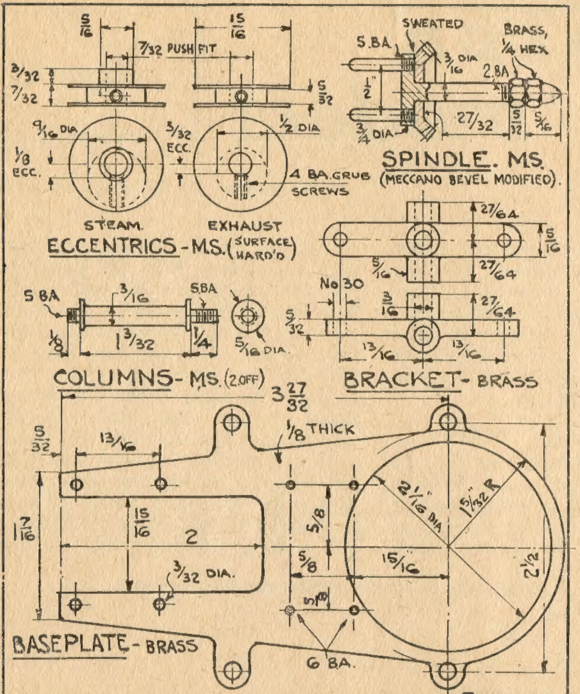


FIG. 4.

Above: Baseplate, eccentrics and spindle

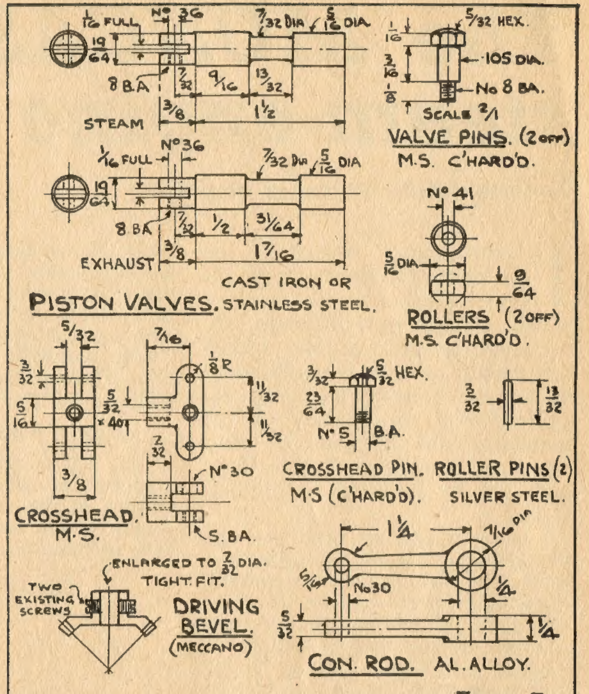


FIG. 5.

Above: Valves, connecting rod and crosshead

Below: Eccentric rods and flywheel

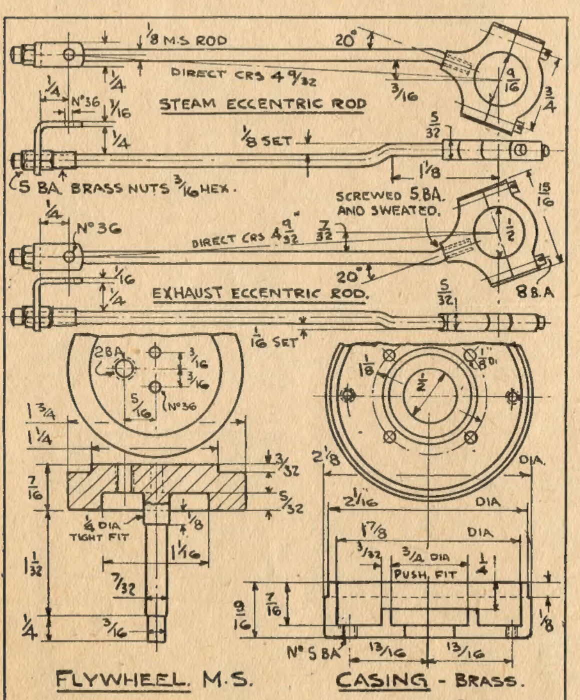


FIG. 6.

Below: Details of lubricator

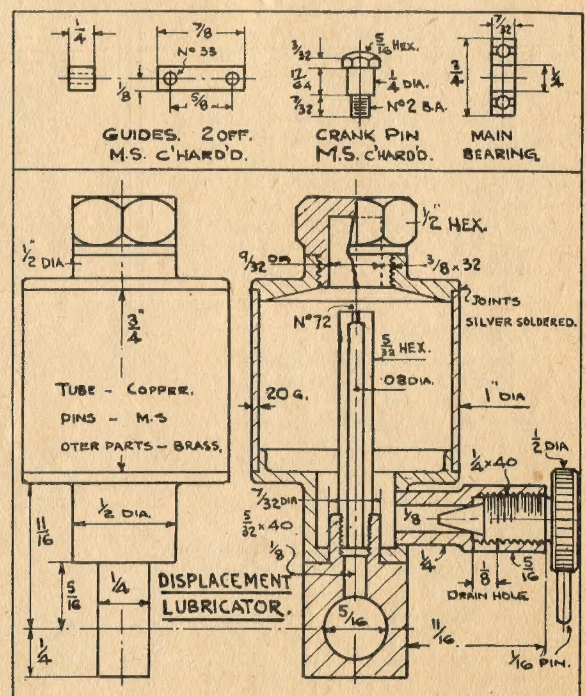


FIG. 7.

The MUNCASTER steam-engine models

By
Edgar T.
Westbury

7—Entablature or table engines

Continued from 2 May 1957, pages 634 to 636

IN THE EARLY STAGES of its evolution, the steam-engine assumed various forms, some of which, though now obsolete, are of great interest to the model constructor. Design was influenced by several factors, including expediency or convenience in the materials and methods of construction available at the time; and also by traditional structural styles.

I have already explained that the preferred position for the cylinder—which was then usually the heaviest single component—was on the floor or bedplate; the difficulty of producing accurate straight slides, capable of resisting side thrust without undue friction, favoured the use of parallel motion for guiding the piston rod, or indirect action with long connecting rods, such as in beam, return-crank and steeple engines.

The class of engine known as the "entablature" or "table" engine made its appearance very early in the 1800s, but became most popular in the middle years of the century. Some very fine examples of these engines by Maudslay and other prominent makers were shown at the 1851 Crystal Palace Exhibition; they varied a good deal in design, some being of the indirect-acting type, with the crankshaft below the cylinder and the piston rod extended upwards to a rather spidery crosshead from which motion was transmitted by side connecting rods to the crank.

Architectural term

Others, such as the types illustrated here, had the cylinders mounted on the bedplate and the crankshaft mounted on an elevated platform—probably the first attempt at what came to be known as "direct-acting" engines.

In common with many other terms in engineering, the word "entablature" is borrowed from architecture, being in fact a legacy from the classic Graeco-Roman era. Its definition (to quote a standard architectural text-book), is "the horizontal member or members supported by the columns, and including the cornice, frieze and architrave."

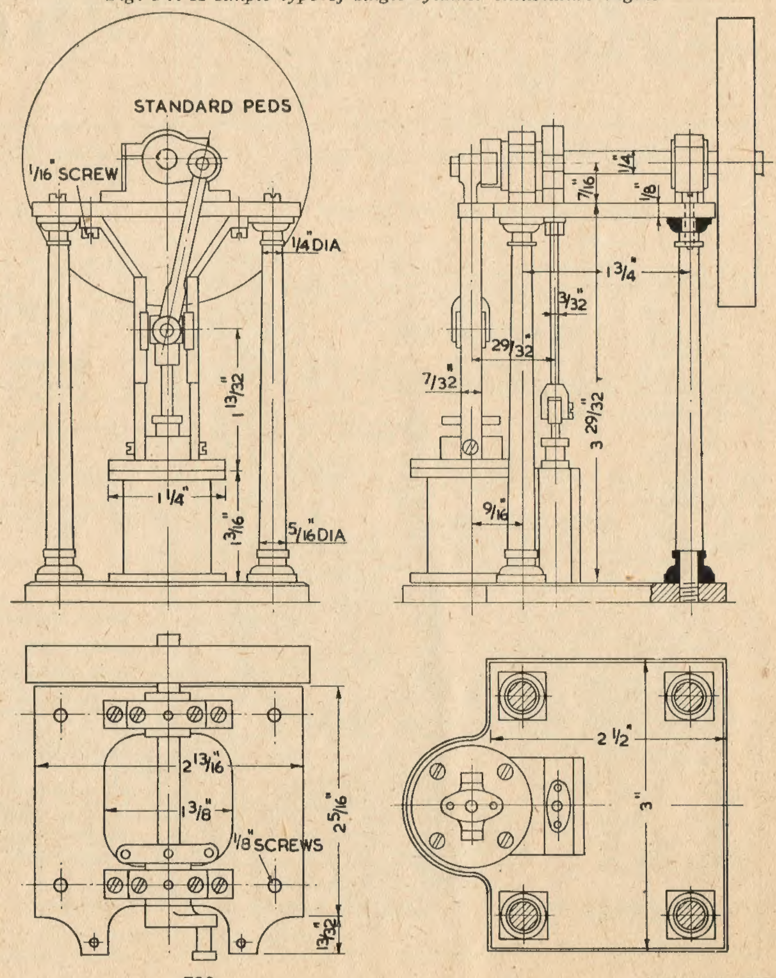
All engines in this class, therefore, have the common feature of a flat elevated table supported by four (sometimes more) columns—comparable in fact to the humble kitchen table. Many of the classic examples of these engines had fluted Corinthian columns with decorated capitals and moulded edges to the entablature.

SIMPLE "BASIC" DESIGN

The engine illustrated in Fig. 34 represents one of the simplest possible designs in this class, being reduced almost to the point of austerity, yet fully in character. It is of the direct-acting type, having a sliding crosshead with bar slides. Both the baseplate and the entablature are made from flat plate, the former being ¼ in. thick with chamfered top edges, and the latter ⅛ in. The columns may be built up, as indicated in the part section, the ends being shouldered down to form studs, with separate capitals and pedestals fitted to them.

This is economical with material, but I have a predilection for making things in one piece where this is possible by straight-forward machining and I think I should prefer to turn

Fig. 34: *A simple type of single-cylinder entablature engine*



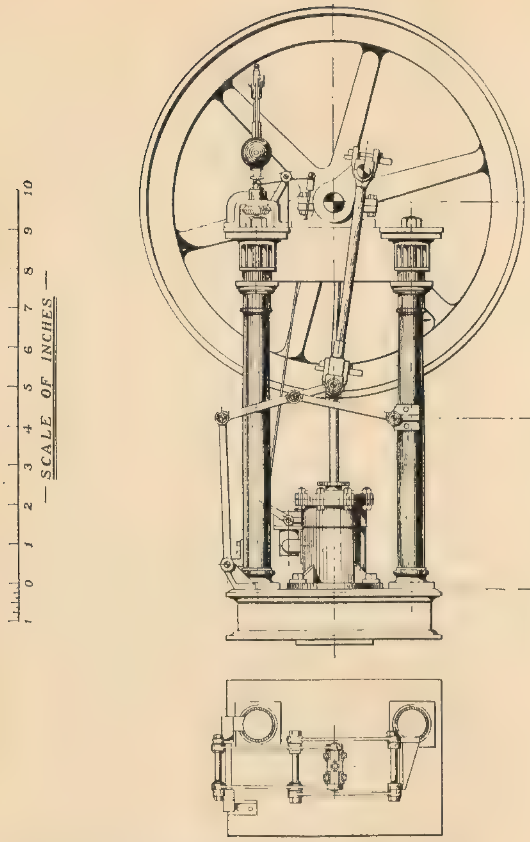


Fig. 35: Side view and motion work plan of the double entablature engine with parallel motion crosshead

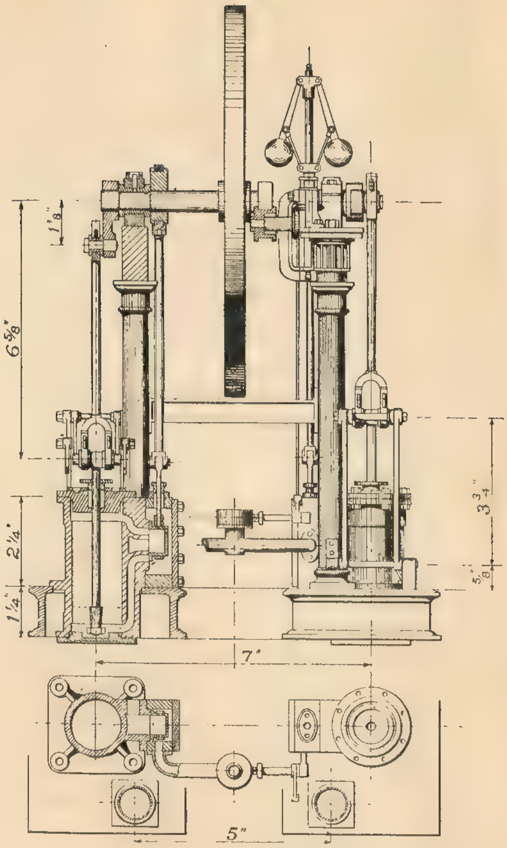


Fig. 36: End view and the cylinder plan of double engine

them from ½ in. square bar, leaving flanges about 1/16 in. wide unmachined at each end, with simple mouldings adjacent to them and the rest of the shank tapered from 5/16 in. to ¼ in. dia. Needless to say, the length between flanges must be the same in all cases, and not only must the flanges be square with the sides of the entablature but the latter must also have square corners, not rounded; as Muncaster says, "it is a sound rule in architecture that no cylindrical part appears about the square cap of a column."

Brass is often used for the structural parts of these steam-engine models on the grounds of appearance, or avoidance of rust, but in the prototypes nearly all parts were made of cast or wrought iron. The cylinder is ¾ in. bore × ¾ in. stroke, the design, including slide-valve, etc., following conventional practice. Piston and valve rod glands have oval flanges and the sides of the stuffing-box on the cylinder cover have flat surfaces for the attachment of the slide bars.

The latter are splayed outwards at the top, with horizontal lugs to fasten to the underside of the entablature, but the sliding surfaces must be exactly vertical and parallel to the cylinder axis both ways. It is probable that these were intended to be forged to shape, and machined or filed only on the working surfaces; but most constructors will probably find it best to cut them from the solid.

The crankshaft, of the overhung type, has a ¼ in. dia. main journal and runs in plummer block bearings mounted on the flat surface of the entablature; the web or crank disc has a pin 5/32 in. dia. fitted at ⅜ in. radius, either by screwing or pressing in. A spoked flywheel, 3 in. dia., is fitted and it may be observed that if character is to be as faithful as possible both the rim and spokes should be thinner than is usual in modern practice.

The eccentric is attached to the shaft as close as possible to the main bearing, thus serving as an end locating collar, and this should enable the rod to be lined up with the valve rod without bending, which is always unsightly and frequently quite unnecessary. Forked ends are employed on both the connecting rod and the eccentric rod; the crosshead is of H-section with grooved faces to embrace the slide bars. Despite its simple construction, this design can be made into quite a handsome and dignified model and an efficient worker.

TWIN-CYLINDER OR "DOUBLE" ENGINES

The two further examples of engines in this class, illustrated in Figs 35, 36 and 37, are both the "double" type, having overhung cranks at either end of the shaft and a central flywheel; but the design could quite easily be adapted as a single-cylinder engine if desired. They are also much more elaborate in design than the foregoing example and best suited to construction from castings, though many, if not all, of the components could be produced by machining from solid or fabrication by brazing and soldering. The latter methods are often preferred by constructors who wish to obtain the utmost accuracy in details such as fluting and other forms of decoration, which was such an attractive feature of these old engines.

Very little descriptive matter was furnished by Muncaster on these engines; the drawings were considered to be self-explanatory, at least to those readers who were sufficiently experienced to be likely to take an interest in their construction. Taken in conjunction with previous examples of design and functional details, I think that most of the essential information will be found in the drawings.

The major difference between the engine shown in Figs 35 and 36, and that in Fig. 37, is that the former was fitted with parallel motion to the piston crossheads and the latter with slide bars; this would probably, but not necessarily, be a guide to period, as the earlier engines were less likely to be fitted with sliding crossheads.

In the particular type of parallel motion illustrated, the geometry is simple and obvious; it was ued on many types of engines, both horizontal and vertical, though in the latter case the ends of the radius rods were more often anchored from brackets fixed to the walls of the engine house than from columns; in a few cases, however, short rods anchored to lugs extended from the sides of the cylinders were used.

The use of a deep bedplate or plinth with the cylinder partly or completely sunk into it, in conjunction with an equally deep entablature, not only enhances the dignified appearance of the engine, but by enabling shorter columns to be used, increases the rigidity of the structure.

In the two engines shown in Figs 35 to 37 it appears that two separate plinths are employed, and also separate entablatures in the form of box girders; but I should prefer to employ a single plinth and a rectangular frame entablature; even in an engine having only one cylinder this form of construction would give maximum strength and simplify lining up.

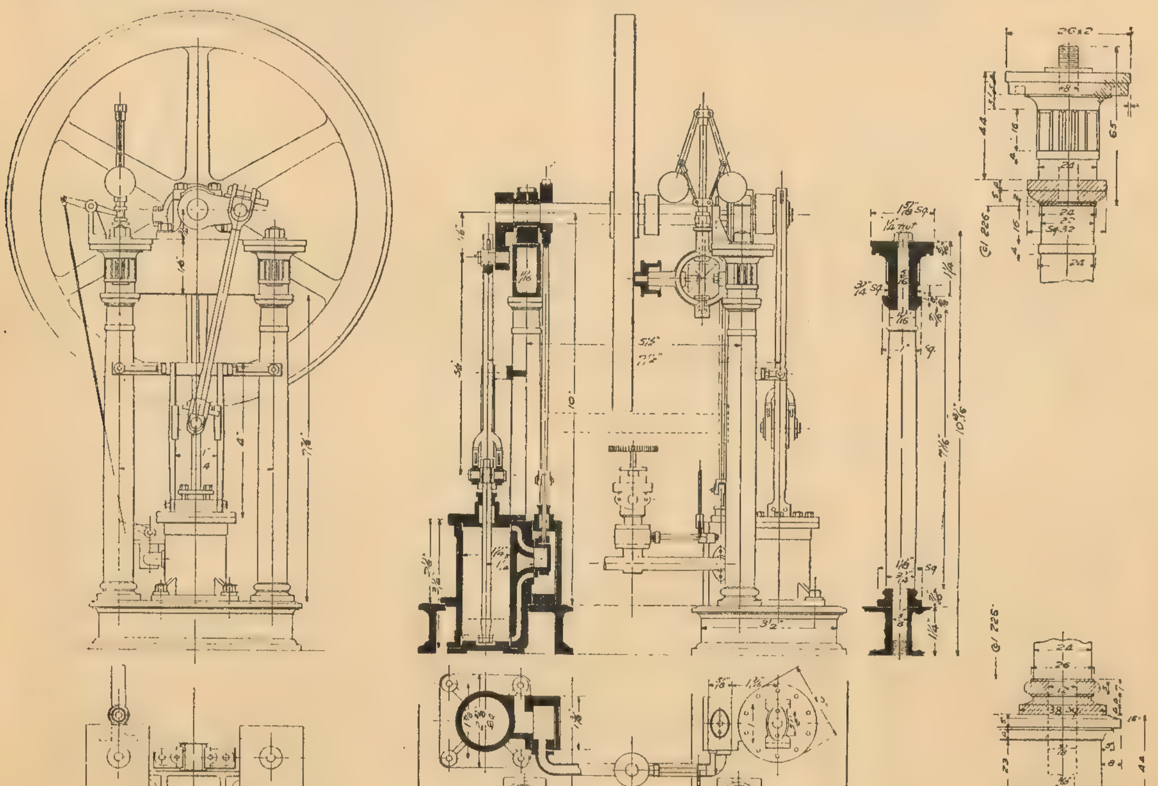
Note that the columns are not turned to a straight taper but are slightly convex or "fish-bellied"; this is correct to architectural traditions and improves the appearance so long as it is not overdone. In the details of column pedestals and capitals on the right of Fig. 37, the exact shape of mouldings, etc., is shown, most of the dimensions being given in 32nds of an inch. The connecting rods have gib and cotter fixings for both the crankhead and crosshead bearings, the latter being forked. A belt-driven governor is fitted, operating a butterfly throttle on the steam supply line which connects to the two cylinders by a horizontal branch pipe.

When the drawings of these engines were published one or two of the details were mildly criticised by meticulous students of period steam-engine design; for instance, it was suggested that the flywheels had too great a radial depth of rim, and that four spokes should be used instead of six, also that the crankshaft should be of square section, turned only on the journals, with the flywheel and eccentric sheaves staked on.

I have no doubt that the critics were well informed, but apparently Muncaster made some concessions to simplicity in castings and machining procedure—just as I do myself—and if every example of a model purporting to be a true period piece were as correct as his drawings I for one should be very well satisfied. Incidentally, the drawings for Figs 35 and 36 were made by my colleague, J. N. Maskelyne, and are a fine example of engineering draughtsmanship.

● *To be continued*

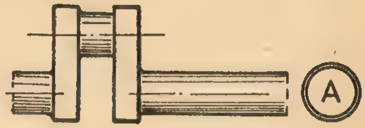
Fig. 37: *Another double engine with sliding crossheads, showing details of columns*



DOUBLE-WEB CRANKSHAFTS

BEGINNER'S WORKSHOP

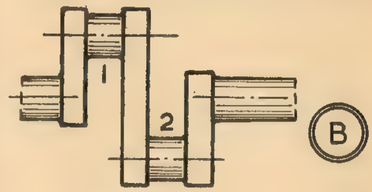
By GEOMETER



WHILE the double-web or full crankshaft is a more complicated component than the single-web type, it admits of greater choice in engine layout both for essential components and auxiliary drives.

Thus, for a steam-engine, eccentrics for valve-gear and water-pump operation can be on the side of the crankshaft, away from the flywheel; and similarly for a four-stroke internal combustion engine there is freedom to set out the valve gear in several different ways, according to what may be considered desirable or expedient.

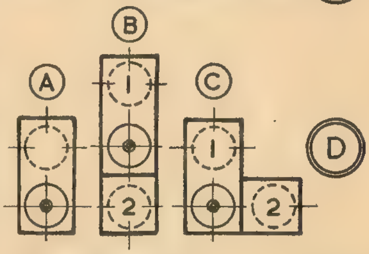
For these advantages, the penalties are more work in producing the crankshaft; material retained in the soft condition—since it is impossible to harden the crankshaft, and split big-ends to the connecting rods—unless a complicated built-up crankshaft is used. In most instances the choice for a simple single-cylinder or multi-cylinder engine in model sizes is a machined-from-the-solid or permanently built-up crankshaft of steel, and connecting rods with split big-ends of brass, bronze, or white metal.



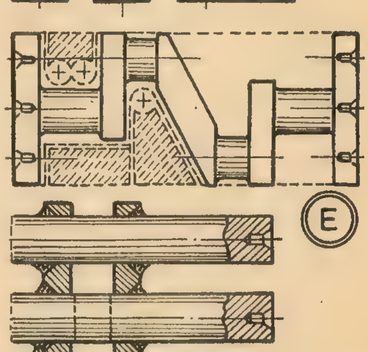
Types of crankshaft

Diagrams *A*, *B* and *C* show types of crankshaft employed in single and twin-cylinder engines. That at *A* may be used in a single-cylinder double-acting steam-engine, or in a single-cylinder internal combustion engine—when it usually has balance weights. That at *B* is employed in flat twin or horizontally opposed internal combustion engines, where the cylinders fire alternately. The crankshaft at *C* is the type required for twin-cylinder double-acting steam-engines where the crankpins are at 90 deg.

At *D* appear end views of the crankshafts, and it can be seen that types *A* and *B* can if desired be made from solid rectangular material, but that type *C* would require a square section. Hence, it might be decided that while types *A* and *B* could be made from the solid without too much labour, type *C* would be better built up.

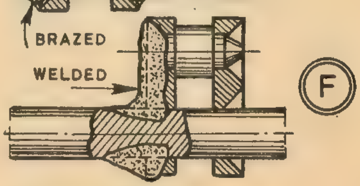


A crankshaft for a vertical twin-cylinder single-acting steam-engine can be made from solid rectangular material as at *E*. This crankshaft is similar to that at *B* for the flat twin internal combustion engine, but the crankpins are further apart and the centre web is at an angle instead of being straight.



The method of preparation for either of these crankshafts (and for single-cylinder types) is as shown. The steel bar is cut and faced to overall length-plus. On a surface plate, the ends are marked with throw centres for these to be centre-drilled. Surplus material is cut away by drilling and hacksawing, then the crankshaft is rough-machined—advisedly gripping one end in the independent chuck for a firmer drive and more rigid support than can be obtained between centres. Finally, of course, the crankshaft is finished between centres and the throw "plates" sawn off for the ends to be turned.

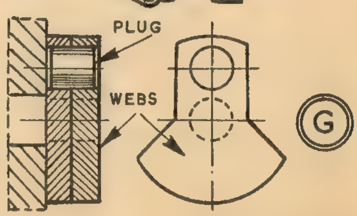
For built-up crankshafts, over-width flat or rectangular-section material is used for webs, and over-size round material for crankpins and mainshafts. For machining the crankpin of a single-cylinder crankshaft, as is usually necessary, the crankpin rod can be as long as the mainshaft and centred as at *F*. After the brazing or welding, the mainshaft is sawn away between the webs and the crankpin machined. Then the surplus material is cut off outside the webs and the mainshaft turned.



When there is more than one crankpin, plates must be fixed to the mainshaft, either brazed, welded or clamped, on the principle at *E*. On occasion, however, with careful brazing crankpins need only be cleaned up with emerycloth.

For brazed crankshafts, crankpins and mainshaft can be parallel and the webs slightly countersunk; but for welding, a stepped crankpin is advisable with the ends chamfered and the webs deeply countersunk. Penetration as shown should be aimed at in welding.

Webs may be extended to form balance weights and should be a good fit for crankpin and mainshaft material. Boring should be with them clamped on a faceplate, or sub-faceplate, with a plug locating the first hole, as at *G*. ■



Whatever the month, you can make . . .

AN EVERLASTING CALENDAR

By Radian

An everlasting calendar of the type described below is easily made and forms a readily accepted gift at any time. With this end in view I decided to construct a batch of six, which occupied one damp weekend.

The base (Fig. 2) was turned from a piece of $1\frac{1}{2}$ in. dia. brass rod which was gripped in the three-jaw chuck and faced across the end, followed by a truing cut on the diameter. The curved profile was put on with a makeshift ball-turning tool, made up by putting a round nose tool in the four-tool turret and rocking it horizontally about the turret pivot, using as a handle an odd length of $\frac{3}{8}$ in. square rod clamped in the turret opposite to the tool.

The turret clamping lever was removed and two locknuts substituted to give free rotation without vertical play. After removing the tool marks with emerycloth and producing a high finish on the profile with metal polish while running in the lathe, a 2 B.A. thread was tapped in the centre of the base, which was then cut off with a rear-mounted parting tool, using a very fine feed and copious lubrication.

Half-round seating

The base, gripped on a piece of adhesive tape to protect the polished surface, was reversed in the three-jaw chuck and faced on the bottom, after which a $\frac{1}{2}$ in. dia. hole was drilled $\frac{1}{4}$ in. deep and the base was finished with a flat bottom by the use of an endmill. To make the half-round seating for the tube, the waste was sawn and filed away to give a rough shape and the base was mounted on an angle-plate by means of the 2 B.A. tapped hole provided. The angle-plate was in turn mounted on the lathe faceplate with suitable balance weights, and the seating finished to size with an ordinary boring tool. After removing the component from the angle-plate, the 2 B.A. thread was drilled out with a $\frac{3}{16}$ in. drill.

The housing

The housing was made from a 5 in. length of 1 in. dia. 20-gauge brass tubing which was mounted on a hardwood mandrel turned to a drive fit in the bore of the tube and extending 2 in. beyond either end. This wooden core was bolted to the boring table of the ML7 lathe with suitable packing blocks interposed so that the sides of the apertures, when cut with a $\frac{1}{4}$ in. endmill, were radial, this being achieved by milling along one edge and reversing the tube end for end to mill the opposite edge.

The slot ends were squared with a small file and all burrs removed. The tube was then mounted between centres, using the wooden core as a mandrel, and the ends of the tube were carefully faced, taking very small cuts. At an angle of 135 deg. from the centre of the slots a hole was drilled and tapped 2 B.A. in the middle of the tube, which was then polished in a similar way to the base.

After knocking out the wooden core a 1 in. length of 2 B.A. threaded brass rod was screwed into the tapped hole and securely brazed into place, being subsequently filed flush with the bore of the tube.

To prevent the previously polished surface being oxidised, due to the heat of brazing, the tube was thickly coated with ordinary household soap. This burns on the surface but forms a protective coating from the atmosphere and is fairly easily removed with metal polish when required. The surplus brazing spelter and flux was filed away from around the screw since this area is covered by the base.

The indicator barrels were turned from $1\frac{1}{8}$ in. dia. steel rod to be a stiff fit in the bore of the tube. The

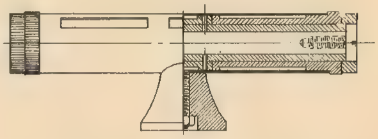


Fig. 1: The assembled instrument

diameter was reduced by $\frac{1}{8}$ in. in the positions shown (Fig. 4), a $\frac{5}{8}$ in. hole was reamed in the centre of the rod and the date ring parted off from each barrel to a width of $\frac{1}{2}$ in., using a $\frac{1}{8}$ in. parting tool as shown. Straight knurling was cut on the $1\frac{1}{16}$ in. dia. portion by mounting a screwcutting tool on its side in the toolpost—with the point at centre height—and winding the carriage back and forth by hand thus slotting the grooves 0.015 in. deep.

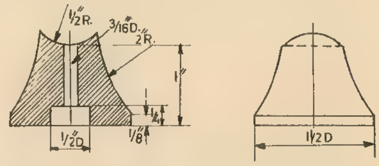


Fig. 2: The base

Indexing was achieved by mounting a train of wheels on the changewheel studs and using the scribing block as a pointer. To cut 200 grooves round the periphery a train of wheels having 75, 50, 40, 30, 25, and 20 teeth was used to obtain a total reduction of 10 to 1. The burrs thrown up by

Fig. 3: The housing tube

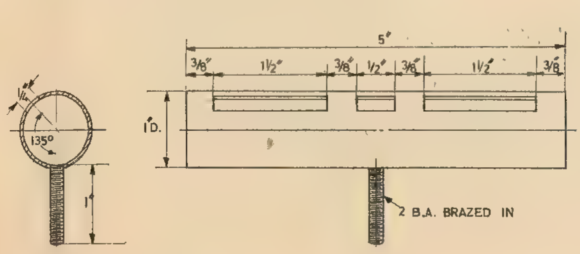
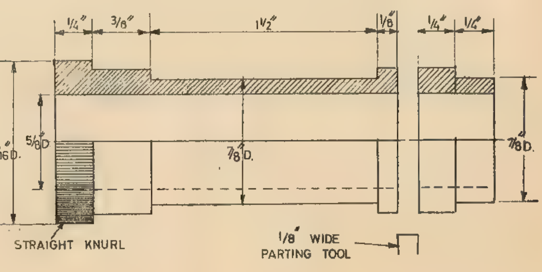


Fig. 4: The indicator barrels



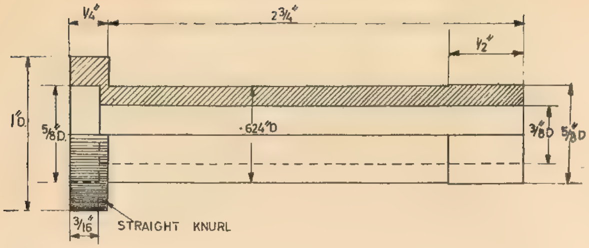


Fig. 5: *The date ring shaft*

knurling were removed with a fine file, and the barrel was parted off, after which it was reversed in the chuck and the sharp edges removed. Each of the 12 barrels in the batch under construction was dealt with similarly.

A length of 1 in. dia. steel rod was turned down to a push fit in the date ring and then reduced by 0.001 in. as shown in Fig. 5. A $\frac{3}{8}$ in. dia. hole was drilled through the centre and the end knurled as already described. After parting off and reversing in the chuck, the rod was faced on the end and a $\frac{5}{8}$ in. dia. recess bored $\frac{3}{16}$ in. deep. The face was then brought to a high polish.

After fitting each barrel and date ring on their shafts, a $\frac{1}{16}$ in. dia. crosshole was drilled through each ring and shaft and all burrs were removed. Two retaining screws (Fig. 6) were turned down from a short length of $\frac{5}{8}$ in. dia. steel rod, the ends being slotted across with a hacksaw and then polished. The central retaining rod was made from a length of $\frac{3}{8}$ in. dia. rod with a 2 B.A. thread tapped in each end.

After giving the base, tube, screws and knurled shafts a final polish by hand, they were passed to a colleague for chromium plating.

While waiting for the return of the plated parts, the various indicators were given two coats of black enamel and labelled. The labels were cut from old calendars and glued into place. This may appear to be an inferior method, but it was found to be common commercial practice.

When the plated parts were returned the instruments were assembled as shown in Fig. 1. The day and month barrels were fitted on the shafts and the date rings pinned into place. It should be noted that the crosspins do not pass across the centre hole. The whole assembly is retained by the two end screws and the centre shaft. The base is attached by a 2 B.A. nut in the bottom recess; a disc of felt is glued to the base.

When assembled the barrels should turn stiffly but without moving any other barrel.

When attaching the labels to the barrels it is essential that they are kept straight. ■

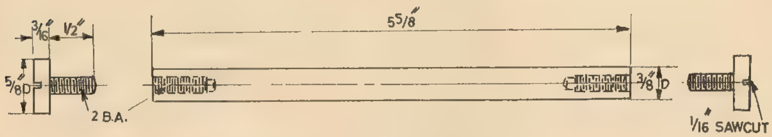
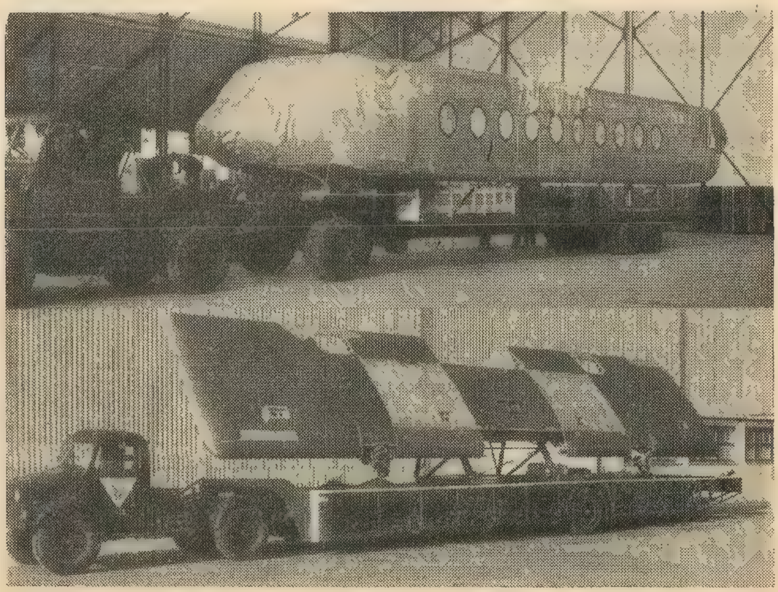


Fig. 6: *Centre retaining rod and screws*

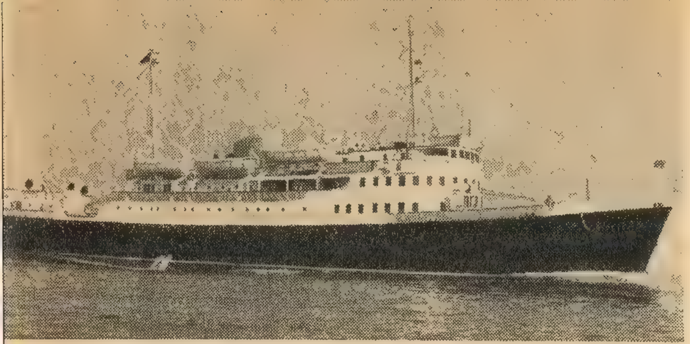
THE WORLD'S LARGEST TRANSPORT HELICOPTER



THE Fairey Rotodyne, largest transport helicopter in the world, was moved recently from Fairey's factory at Hayes, Middlesex, to the company's airfield at White Waltham near Maidenhead, Berks.

The Rotodyne will carry 40 passengers or a payload of 10,000 lb. over stages up to 400 miles at overall speeds and costs comparable to those of fixed-wing aircraft. It will cruise at 175 m.p.h.

The power plant consists of two Napier Eland propeller-turbines with Fairey pressure-jets at the tips of the rotor blades. ■



A WORKING MODEL OF ST NINIAN

By Edward Bowness

Part 10: Continued from 2 May 1957, pages 630—632

WITH the promenade deck in position the next step is the construction of the cabins, which are located on it. These are shown in plan in the promenade deck on Fig. 38 [18 April 1957]. They should be made in separate pieces for convenience in erection.

The longest piece, which is about 24 in., is the foremost portion of the cabin around the curved front and aft to the double doors at station 6. The pieces containing the double doors should be made a little longer than shown—say about 1½ in. each—so that the sides can be brought to meet them at right angles and a fillet of solder run in on each side (Fig. 46). The after cabin should be made in two lengths, each of about 17 in. with a joint on the after centre line.

The strips for the cabin sides should first be cut about 1¾ in. wide. The lower edge of each must be fitted to the curve of the deck on which it rests, both transversely for the camber and fore-and-aft for the sheer. When it fits perfectly the upper edge should be cut parallel to the lower. The height of the doors, windows and portholes must be measured from the lower edge as indicated in Fig. 48.

Butt straps should be fitted on the inside, above and below the doors, leaving a flush joint on the outside. This should be made as neatly as possible so that when painted it is invisible. I think these doors could be shown open, as they would help to ventilate the engine and boiler room.

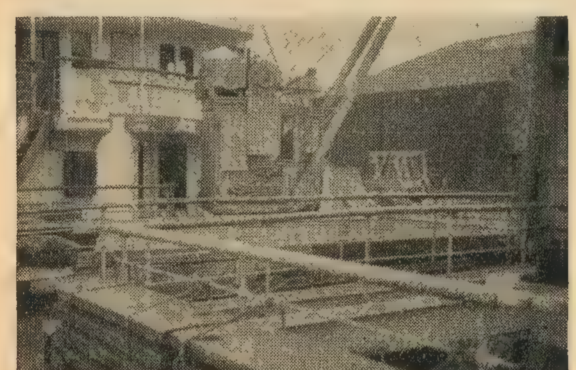
In this case they should be sawn where they meet and along the top and bottom, and a line scribed on the hinged edges so that they can be bent open without difficulty. A very fine saw is necessary so as not to give the impression of the doors being too loose a fit. The same remarks apply to the doors at station 6, these also being left open for ventilation. The dimensions for the plan of the cabin are given in Fig. 47 and for the portholes and windows in Fig. 48.

When all the sides are prepared they should be soldered in position, making a good fillet of solder all round on the inside, the surfaces having first of all been tinned. The angle with the deck outside should be cleaned of any solder which has worked through, as you will require a sharp corner for the deck planking.

The transverse bulkheads with the double doors (Fig. 49) should now be fitted. On Fig. 38 it will be noticed that whereas the hance at promenade deck level touches the line of station 7, the bulkhead on the same deck is about 0.2 in. aft of it. Obviously this should not be so. As the hance has already been cut in making the curved front (Fig. 41) the bulkhead should be moved forward a little to coincide with the curve. The picture taken looking forward along the promenade deck shows this feature.

These bulkheads are made of teak with teak doors, so they could be made of dark wood. (If made in metal they should be painted brown.) The doors should be shown closed, being merely scribed on. It will be seen that these doors are glazed. This could be reproduced in the model, but as they are not very prominent it is scarcely necessary.

In the actual ship there is another doorway in each of these bulkheads, inboard of the double doors. These give access to the foyer on the deck below, but as, owing to their position, they would be practically invisible in the model, it is better to ignore them altogether. The double doors at station 6 and on the centreline aft are also made of teak and glazed. But they have steel frames—being merely set in the steel sides of the cabins. The doors will, therefore, be painted brown and the frames white, as for the cabin walls. A kicking strip or skirting about 0.2 in. wide should be painted all along the cabin walls next to the deck. This painting



Left: View of after end of the midship superstructure

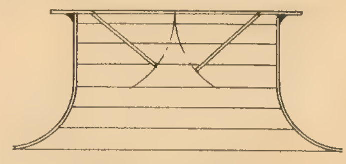


FIG 46

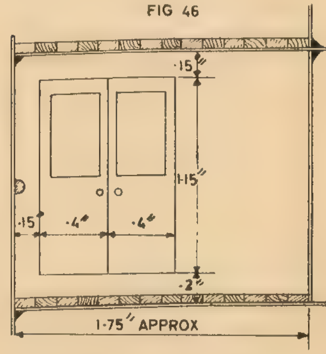


FIG 49

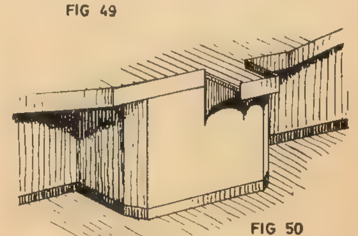


FIG 50

Right, Fig. 46: Plan of the side entrance to the cabins. Fig. 49: Transverse bulkhead (port side). Fig. 50: Platform for the stairs at the after end of promenade deck

should be done before proceeding further as it will soon be inaccessible.

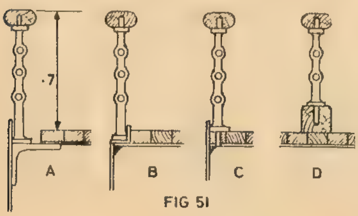
Handrails—or stormrails as they are sometimes called—should be fitted around the cabins. They are of 20 s.w.g. brass wire and are held by brackets [see Fig. 37, 4 April 1957]. They run along the straight sides of the cabin, being 3.7 in. long forward of the side entrances and 11.85 in. long aft of them. On the after end of the cabin there is a 1 in. length on the port side from the rounded corner to the ladder from the boat deck, and on the starboard side a $2\frac{1}{2}$ in. length from the double doors to the corner.

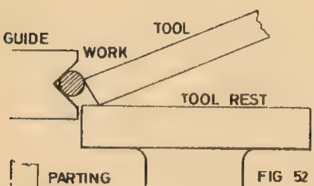
PLANKING THE DECK

Before starting the planking you must add the flange at the after end of the promenade deck. This extends right across the ship except where it is interrupted by the platform at the head of the ladder leading to the shelter deck. It is shown in Fig. 39 [18 April 1957] and in the picture in this issue. It is made of a strip of tinplate $\frac{1}{4}$ in. wide, soldered to the edge of the promenade deck and along the projecting portion of the bulkhead below it. It is curved to suit the camber of the deck and projects $\frac{1}{8}$ in. above it. At each end it meets the side plates to which it is soldered. The platform is 0.6 in. square, is level with the deck and is supported by a more-or-less triangular web at each side as shown in the picture and in Fig. 50. The starboard web is $\frac{1}{8}$ in. higher than the platform and should be continued across its after edge, whereas the web on the port side is flush with the deck.

The planking should now be laid fitting it closely to the bulkhead forward, around the cabins and along the sides. The run of the planks is shown in Fig. 38. In this drawing the wide strip all round the deck is the handrail. The planks fit closely to the sides and must be cut away later for the supports for the Schats davits. Incidentally in Fig. 38 six of these supports are indicated; actually there are only four, the davits for the two forward boats being carried entirely by the boat deck.

Another point; the planks opposite the small platform at the after end of the promenade deck should continue to the after edge of this platform. These points have been corrected in the large scale drawings.





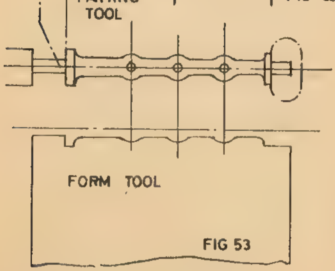


Fig. 51: Types of stanchion
Fig. 52: Set-up for turning stanchions
Fig. 53: Form tool for turning stanchions

HANDRAILS AND STANCHIONS

The forward portion of the promenade deck on each side will be covered when the boat deck is fitted, so it is necessary at this stage to give some consideration to the handrails and other items which will then be difficult of access. Forward, the handrails disappear from view behind the curve of the hance and continue inside the side plating to the transverse bulkhead. This is clearly seen in my picture of the forward end of the promenade deck.

The handrail is supported on stanchions and, as will be seen from the picture looking aft along the promenade deck, it has four rails in addition to the teak rail on top. This raises the question of how many rails to show. The purist would unhesitatingly say four whereas I would suggest three. I have been taken to task before for suggesting simplification in a case like this, but I still maintain that in a working model such simplification is justifiable.

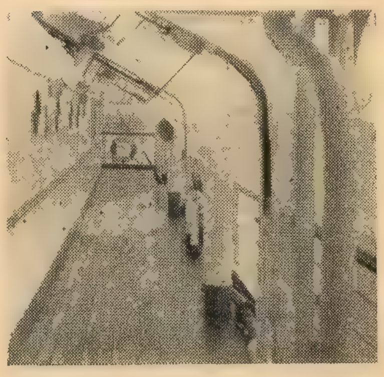
If certain details are scaled down conscientiously they become too fragile for handling at the pond-side. If on the other hand they are made overscale for practical considerations and are not simplified in some way, they look fussy and overcrowded. So although I have shown four rails in the superstructure in my general arrangement drawing [17 January 1957] I would strongly advise fitting only three. On the shelter deck and the after deck house there are only three rails, so you could adhere to this and make all the stanchions for three. The specification for the railings states that they are 3 ft 6 in. above the wooden deck with a top rail of 8 in. × $2\frac{1}{2}$ in. teak.

Looking forward along the promenade deck, showing transverse bulkhead

On the ship the stanchions are, generally speaking, bolted or riveted to the flange around the deck, but I think if you drill holes for those on the promenade and boat decks and have a projecting end on the stanchion which is a tight fit in the hole, it will be quite satisfactory. If the builder prefers to solder them to the flanges on these decks he would have to do this before laying the decks to avoid scorching the planks.

The stanchions on the shelter decks both fore and aft, and also those on the after deck house, should be soldered in position to give them greater strength and rigidity in their more exposed position. The waterway between the edge of the planking and the flange at the side of the hull, which is approximately $\frac{3}{16}$ in. wide, provides a metal base for them and plenty of room for soldering.

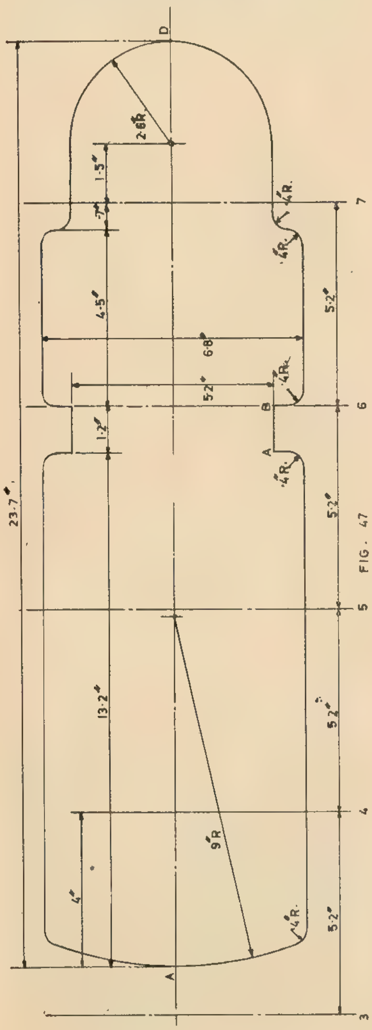
Some of the stanchions are mounted on the deck and others on ➡



Looking aft along promenade deck

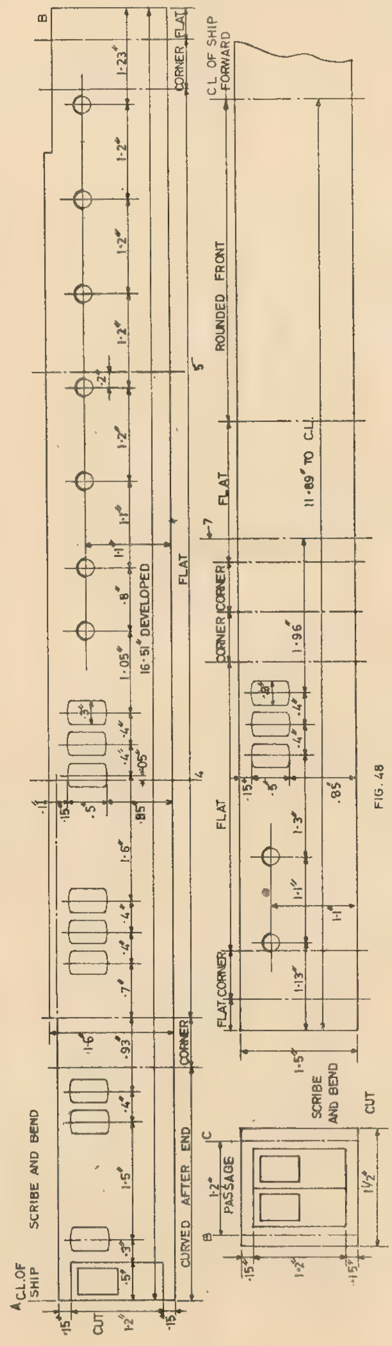
the angle iron and that involves a difference in the design of the base. Fig. 51 will make this clear. Fig. 51*A* shows the stanchions on the shelter deck and 51*B* those on the after deck-house. Fig. 51*C* shows the stanchions on the promenade and boat decks, and 51*D* those on the hatches on the after shelter deck. It will be remembered that the latter have only two rails with a teak rail on top, as was shown in Fig. 31 [21 March 1957] and that they are driven into holes in a 5/32 in. wooden strip.

Fig. 47 : *Plan giving dimensions of the cabins on the promenade deck.*
Fig. 48 : *Elevation showing windows and doors in the cabins*



MAKING THE STANCHIONS

There are various methods for making stanchions, but for the builder who has even the simplest of lathes they may be made without much trouble. If the lathe has a hollow mandrel so much the better, but if not, it only means that the wire must be cut into shorter lengths. You will require brass wire of 10 or 12 s.w.g.



The idea is to put the wire through the hollow mandrel or direct in the chuck with about 2 in. projecting. As it revolves the end of the wire is supported loosely in a suitable V, arranged as shown in Fig. 52. A form tool is made from a scraper or a piece of tool steel about $\frac{1}{8}$ in. thick, having the outline of the stanchion filed on its cutting edge. The tool rest is brought up close to the V-guide so that the tool can be used with a scraper action. I have seen tiny stanchions turned commercially in this way at a surprising rate of output.

Fig. 53 shows the outline of the stanchion 51*A*, and of the form tool required to produce it. A separate tool can be used to cut off the stanchions as they are formed, after which the chuck is freed and the wire brought forward another length.

The jig for drilling the balls is a simple matter, and the builder may be left to choose the design best suited to his facilities. In the ship the rails are $\frac{3}{8}$ in. dia. throughout, except on the boat deck where they are $\frac{3}{4}$ in. A slight flat should be filed on each stanchion in line with the hole, so that it can be fitted as closely as possible to the side of the flange at the edge of the deck.

The spacing of the stanchions varies from about $\frac{3}{4}$ in. to 1 in. apart, according to their location and the proximity of davit rails, pillars and bollards, and for other reasons. I estimate that about 60 stanchions will be required to 51*A*, with an additional 33 to 51*B*. These can be made by the same form tool. Eighty-three will be required to 51*C* and 32 to 51*D*. This involves making three form tools, but they are fairly easy to make. There are a few extra stanchions with ball tops; these I will describe later.

Some ingenious methods have been devised for making rail stanchions, including their manufacture from split pins. But so many are required —and correct ones can be produced very quickly by the method here described—that it is well worth while making the necessary rig and tools. It is very doubtful if they could be purchased correct to the scale required, and in any case they would work out rather expensive.

The rail should be made of dark walnut if possible, as it has a closer grain than teak or mahogany. It could be made a little over-scale, say $\frac{3}{16}$ in. × 3/32 in. The holes for the stanchions should just miss coming through, and a drill with a stop should be used for drilling.

To be continued

THE SWING-CLEAR BORING TOOLHOLDER—2

In this intermediate instalment MARTIN CLEEVE begins the constructional notes with observations on screws and fitting

WHEN MAKING the prototype of this holder I just waded in and tackled any part which took my fancy and for which material was readily to hand—a sort of happy-go-lucky approach during which I thoroughly enjoyed myself for the whole of one Sunday and the following two afternoons and evenings; the total estimated time being 15 hours.

I feel sure that those of you whose interest lies in the accessory direction will derive equal pleasure from its construction which, with the aid of the drawings, will be within the capacity of all.

Drawing Notes

Strictly speaking, a machine drawing should carry complete instructions right down to the most minute detail, the theory being that an engineer should be able to construct the part without asking questions, and in such a way that other components made by another engineer will fit those made by the first.

In this respect amateur engineering differs slightly from regular practice but, though he may not realise it, when the amateur works from the type of drawing here given without consulting the text he is really doing the work of a skilled toolmaker, for he has to make his own decisions with regard to percentage of thread, sizes of clearing holes and similar details. To a large extent he has the pleasure of taking the reins.

However, to cover the drawings with "limits" and other minutia only hinders rather than helps and I think that, on the whole, readers prefer the "bare bones" save in exceptional circumstances.

HEXAGON SOCKET SCREWS

Now, something about hexagon socket-head cap screws.

This swing-clear holder forms a typical example of a mechanism which would be very difficult to construct without their use, at least as a pleasing, and compact unit. This remark applies particularly to the way in which the toolholder (Fig. 8), is fixed to the arms and spacer, the screw heads being fully sunk in the base of the slot. The slotted type of countersunk or cheese-headed screw, if used at this point, could not be tightened to a satisfactory degree, while the limited space obviously rules out the use of ordinary external hexagon-headed screws.

The only remaining alternative (apart from going to a ridiculous amount of trouble machining $\frac{5}{16}$ in. dia. spigots on the ends of the arms and force fitting them to the holder) is to braze or weld—messy operations for which I have no taste when applied to this type of toolmaking.

The customary method adopted for sinking the heads of cap screws is to form the counterbore by means of a tool, something like an endmill, provided with a plain spigot to act as a guide; although these produce a flat seating for the underside of the screwhead, they are about 20s. for each size—an uneconomic price for the amateur who, if he has not made his own set, may as well form the counterbore with ordinary twist drills.

This method has been found quite satisfactory but, as the seating formed in this way is of a conical nature, the underside of the screwheads should be chamfered to a similar angle, as at Fig. 5, to provide a reasonable area of contact and to facilitate tightening. The chamfering operation may be carried out quite quickly in the lathe. It is necessary to take only one cut with a left-hand knife tool (Fig. 6) the blade of which has been set by reference to the cutting edge of the drill used for countersinking. During setting, the shank of the drill is held parallel to the lathe bed.

Although commercial cap screws are made of a very high-tensile steel, they are capable of being machined fairly easily in this manner. Of course, only the minimum necessary should be allowed to project from the chuck jaws.

The nominal diameter of the head of a $\frac{1}{4}$ in. B.S.F. cap screw is $\frac{3}{8}$ in. The direct opening-out of a $\frac{1}{4}$ in. hole to this diameter with a drill often results in an acorn-shaped hole which, in those cases where it is open to view, looks very unsightly. I have found that this may be obviated by enlarging the mouth of the hole with drills successively increasing in diameter by thirty-seconds of an inch. From $\frac{1}{4}$ to $\frac{3}{8}$ in. there are only three intermediate stages before the required size is reached; this may then be used to drill as deeply as required.

There are one or two other points worth taking into account. As remarked above, the head diameter of $\frac{1}{4}$ in. capscrews is $\frac{3}{8}$ in.; occasionally it is a shade in excess of this, while sometimes it will not be quite square and, therefore, reluctant to enter the counterbore. According to circumstances I use either a W-size drill, which is 11 thou "up" on $\frac{3}{8}$ in., or I skim a few thou from the diameter of the screwhead. The use of a 25/64 in. drill does not appeal as it seems to give an unnecessarily large clearance.

For this kind of drilling a speed of from 200 to 250 r.p.m. is quite pleasant.

In those cases where a slight projection will not be inconvenient, finesse is added by allowing the chamfered portion of the screwhead

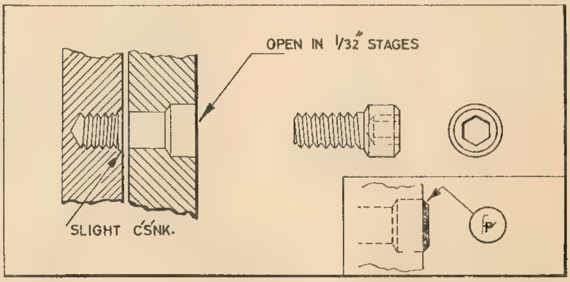


Fig. 5: Countersinking capscrews. Allow the chamfer to show, as at P (inset)

BORING TOOL-HOLDER . . .

to show as at *P*, Fig. 5. In all cases the drawings show a flat bottom counterbore; the reader will now understand why these are not dimensioned in any way.

After a hole has been drilled tapping size it is as well to form a reasonable bevel with a countersink bit before tapping. This ensures that the act of tapping does not allow the first turn of thread to be forced above the surface where it would interfere with the close fitting of the parts to be joined (Fig. 5, left).

Castor oil is an excellent lubricant for tapping mild steel. The debris remaining in the threaded hole may be removed by means of a scriber which has been magnetised by stroking with an Eclipse or other permanent magnet.

With the exception of those few cases where drills are sharpened under controlled conditions with the help of a grinding jig, it is usual to drill a hole larger than its nominal size. It is for this reason that the drawings do not show the usual plussage for clearance. In all cases, as a precaution against the tendency for the larger drills to run off centre, it is as well, after centre punching, to spot with a $\frac{1}{16}$ in. drill to a depth of about $\frac{3}{16}$ in.

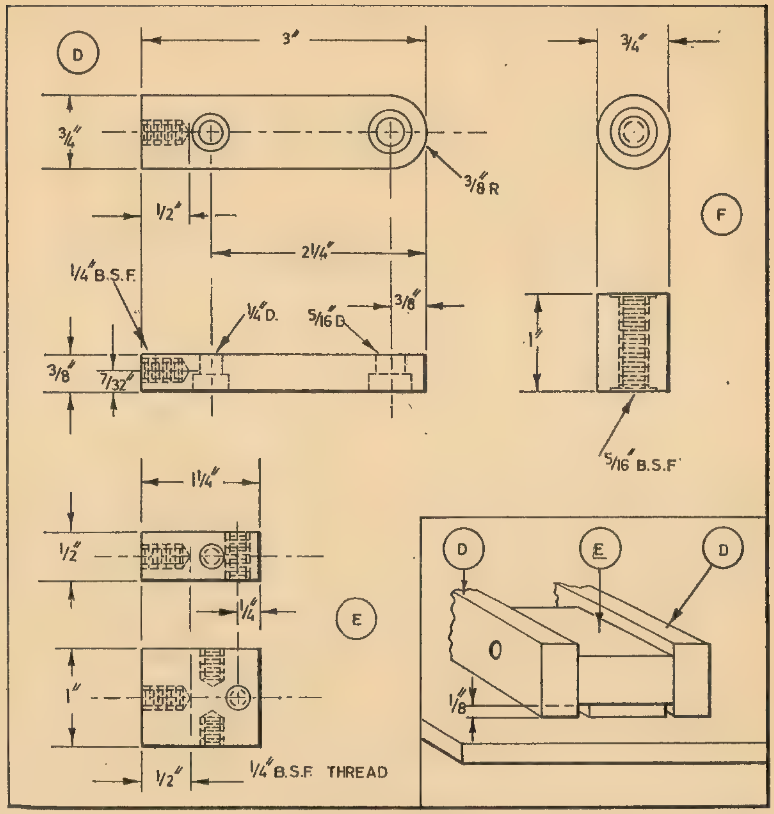


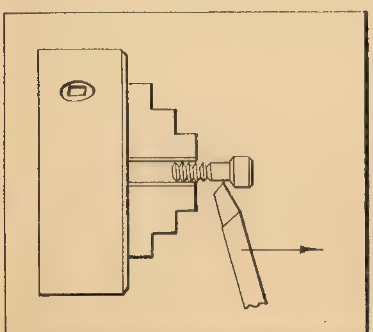
Fig. 7: Details of the arms, D, pivot pin, F, and spacer, E. Inset shows position of the spacer

CONSTRUCTIONAL NOTES

In order to allow for the use of some of the components as drilling jigs for corresponding parts it will be found both convenient and pleasant to follow the sequence and instructions which I am setting out below.

Mount the arms, *D*, Fig. 7, together in the four-jaw chuck and face each end to length plus 1/64 in. On one, centre punch the positions of the $\frac{5}{16}$ in. and $\frac{1}{4}$ in. holes. Spot drill $\frac{1}{16}$ in. Clamp together, drill the radius end $\frac{5}{16}$ in. Drill what will be the $\frac{1}{4}$ in. counterbored hole tapping size for $\frac{1}{4}$ in. B.S.F.—No 3 drill for 75 per cent. thread.

Fig. 6: Chamfering the underside of the capscrew heads before countersinking



It is worth noting that a 13/64 in. drill gives just on 90 per cent. thread which would be unnecessarily difficult to tap, while a 7/32 in. drill allows only 65 per cent. thread which is somewhat on the sparse side. Ignore the tapped holes shown at the left-hand end.

Selecting the most blemish-free surfaces for what will become the outer sides and top, counterbore, or drill, only for the heads of the $\frac{5}{16}$ in. B.S.F. capscrews.

The spacer, *E*, Fig. 7, is 1 in. × $\frac{1}{2}$ in. section. Face each end to length plus 1/64 in. Drill and tap the one $\frac{1}{4}$ in. B.S.F. hole for the height adjusting screw. Ignore the remaining three holes.

The pivot pin, *F*, is $\frac{3}{4}$ in. dia. mild steel. Face each end to the same length as the 1 in. width of the spacer, *E*. Tap right through (easiest in the long run) $\frac{5}{16}$ in. B.S.F. Letter I drill for 70 per cent. thread is quite good enough—17/64 in. drill gives 85 per cent. thread. Recess each end about $\frac{1}{2}$ in. dia. × 1/32 in. depth to ensure a good seating for the arms, *D*. Assemble the arms and pin.

With the assembly flat on a surface plate, insert the spacer, *E*, with the latter resting upon a small piece of $\frac{1}{8}$ in. thick stock so as to position the spacer centrally (Fig. 7, insert).

Clamp over the two arms so as to pinch the spacer in this position and, using the previously drilled tapping size holes in the arms as a jig, drill the spacer $\frac{1}{4}$ in. B.S.F., tapping size each side. Remove the spacer and tap the threads.

Enlarge the tapping size holes in the arms to $\frac{1}{4}$ in., counterdrill for the screwheads. Take care to counterdrill the correct sides. Screw the spacer in position with the outer ends flush. Level by resting upon the previously used piece of $\frac{1}{8}$ in. stock (Fig. 7, insert).

After the arms, spacer and pivot pin had been assembled in this manner, I faced 1/64 in. from that end to which the toolholder (Fig. 8, *C*)

was to be fixed. Having a 6 in. four-jaw independent chuck it was found possible to hold the assembly quite securely, two small plates of metal being interposed between two of the jaws to bridge the gap between the arms.

I think it is worth while facing the three assembled pieces as this ensures a nice flat seating for the toolholder. If difficulty should be experienced in holding the assembly for facing, the reverse method will serve very well, although it is a little more troublesome. This consists of clamping the work to the cross-slide and feeding the end to be machined past a revolving cutter. An illustration of this method of facing will be found in my "Workshop Topics" of 11 October 1956, page 529.

The toolholder, *C*, Fig. 8, is machined from 1½ in. square stock. Face each end square and to a length having exactly the same width as the assembled arms and spacer. In case of doubt it would be preferable, and would look better, to have the block of greater length (1¾ in.) rather than less. Also allow a couple of thou for cleaning off the circular machining lines.

Select those sides with the worst blemishes—if any—skim one side down to a blemish-free surface, reverse in chuck and face down to 1¼ in. thickness.

For milling the slot it was found convenient to use the set-up shown in Fig. 9. In order to adopt this method, which may be convenient to some as it does not call for the use of a vice or vertical slide, it is necessary to drill and tap those holes which ultimately will receive the three screws for locking the tool shanks.

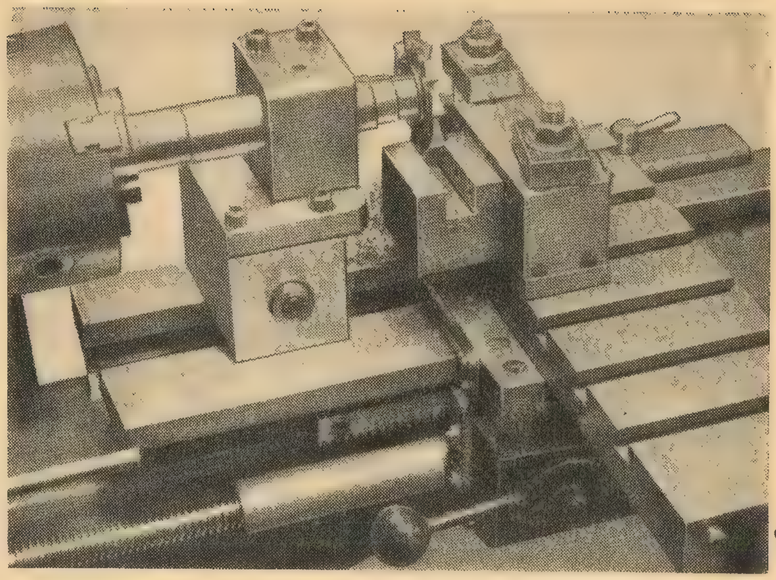


Fig. 9: Two passes under the ½ in. wide milling cutter formed this slot in mild steel

Two of these threaded holes may then be "borrowed" to secure the holder blank to a jig block fixed to the cross-slide by two T-bolts and nuts. Interpose card or stiff brown paper to prevent slipping. To avoid risk of marking what will become the lower lip of the slot, care should be taken not to drill much below the centre line. The reader will see that a similar fixing would be suitable for endmilling if this is preferred, although to minimise risk of breaking the mill it would be as well to make sure it cuts solid metal throughout by initially shortening the depth of the drilled and tapped fixing holes to the appropriate amount necessary.

Upon completion of the slot, mark out, on the rear outer side, the positions of the three fixing holes (Fig. 8, insert). Please note that the outer two are only 7/32 in. from the outer edges. This is to suit the ⅜ in. thickness of the arms and to allow for the satisfactory sinking of the fixing screwheads which are ⅜ in. dia. Drill these three holes tapping size for ¼ in. B.S.F.—No 3 drill.

We'll finish the job right off next week.

● *To be continued*

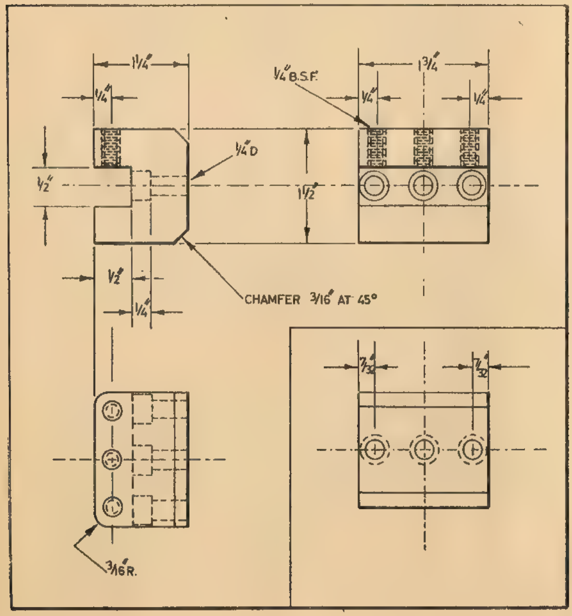


Fig. 8: Details of the toolholder. The rear view showing positions for fixing the screws is shown in the inset

WHY AND HOW OF SOLDERING

Soldering and Brazing by A. R. Turpin deals comprehensively with three categories—soft soldering with alloys of low melting point, hard soldering with higher melting points, and using brasses for brazing with melting points of 800 deg. C, and over. Each category is discussed from the point of view of melting point, plastic range, viscosity, strength, cost and electrical conductivity. Price 5s., postage 3d., from Percival Marshall, 19 Noel Street, London, W.1 (U.S.A. and Canada $1.00).

No 33 By J. N. Maskelyne

L.S.W.R. JUBILEES

ANY reader who is fortunate enough to have access to the Proceedings of the Institution of Civil Engineers for 1885 will know that they include William Stroudley's paper on the "Design and Construction of Large Locomotive Engines."

Stroudley deals very fully with his own 0-4-2 Gladstone class [see Locomotives I have known No 3; MODEL ENGINEER, 22 March 1956]. The interesting point is that in the discussion that followed the paper some eminent locomotive engineers of the time were openly critical of Stroudley's engines—and among the critics was William Adams, locomotive chief of the London and South Western Railway.

Something must have happened during the next two years, however, to cause Adams to alter his views, because in 1887 he produced some 0-4-2 engines of his own, and very good engines they were. In fact, they were so successful that no fewer than 90 were built between May 1887 and May 1895.

The first 30 engines, all built at the railway company's own factory at Nine Elms, had cylinders with steamchests underneath as in Stroudley's engines; but the next 60 engines had the steamchests between the cylinders and were fitted with lever reversing gear instead of screw gear.

My drawing shows one of the first of these engines, unofficially known as "Jubilees" because the year 1887 marked the silver jubilee of Queen Victoria. The chief dimensions were: cylinders, 18 in. dia. × 26 in. stroke, coupled wheels, 6 ft dia. and trailing wheels 4 ft.

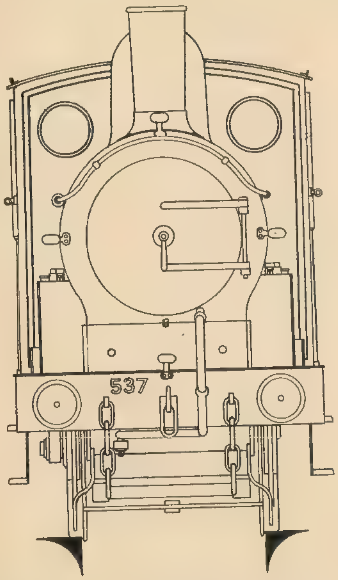
It is interesting to note that the trailing axleboxes had the springs placed behind the frames in all the engines except the first one, No 527, which, when new had the springs in front of the frames. The wheelbase was 8 ft plus 9 ft, and the leading and trailing overhangs were 5 ft 11½ in. and 4 ft 2 in., respectively.

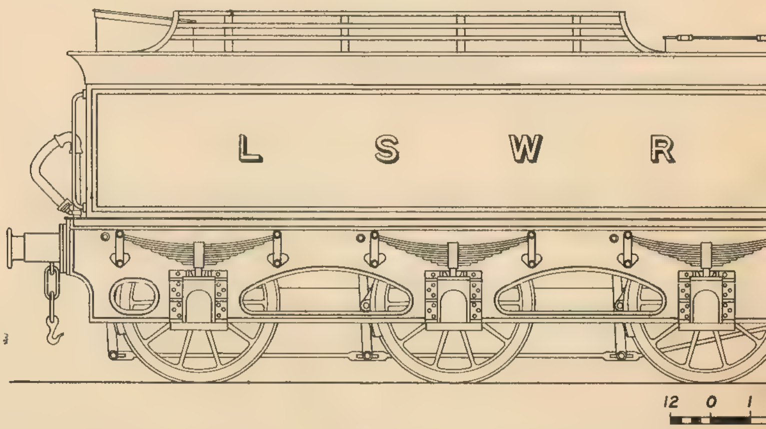
The boiler was 4 ft 4 in. dia. and 11 ft long, the pitch of the centre line being 7 ft 6 in. The working pressure was 160 p.s.i. The barrel contained 216 tubes of 1¾ in. outside dia., the heating surface of which was 1,121 sq. ft; to this the firebox added 110 sq. ft, making the total 1,231 sq. ft. The grate area was 17 sq. ft, and the engine weight was 43 tons 8 cwt in working order.

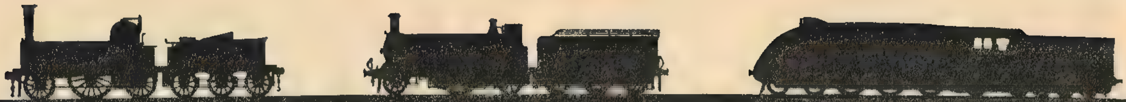
The 60 engines built between 1892 and 1895—40 by Neilson and Co., Glasgow, and 20 at Nine Elms—had brass beading on the splashers, an adornment that was missing from the earlier engines. It was on this class, however, that Adams first introduced to the L.S.W.R. in 1887 his well-known cast numberplate with its highly-polished figures, border, etc., on a bright red ground.

No 537, depicted in my drawing, was an engine I knew well when she worked in the London area, usually on Waterloo-Reading trains. This would be about 1904; but in those days these engines seemed to work mainly on Portsmouth and Reading trains. There were many then stationed at Nine Elms, Guildford, Portsmouth, Reading and Basingstoke, and I think that I must have seen practically the whole class during those early years working trains through Clapham Junction.

They were fascinating engines and always seemed to do their work well. They were never altered very much in later years, though Drummond put a boiler of his own design on about a dozen of them, and his chimney on a great many more. Personally, I much disliked a Drummond chimney on an Adams engine—the effect always seemed to me to be like that of a lifeguardsman in full ceremonial rig







LOCOMOTIVES I HAVE KNOWN

but wearing a cloth cap !

The Adams Jubilees, or, to give them their official designation, A-12s, had a fairly long life. Withdrawal began in 1928, but was not completed until 1948.

In their later years these 90 engines became widely scattered over the L.S.W.R., but the last examples were withdrawn from the London area where, 61 years previously, the first examples had started work. These sturdy, solidly built, hardworking engines were always great favourites of mine, though they could not compare with the easy stateliness and quietness of movement that were so characteristic of Stroudley's Gladstones.

For the benefit of modellers I must add a few words about the Adams stove-pipe chimneys that were used on these engines. There were three varieties: the first was a built-up chimney, the main barrel of which had a slight, almost imperceptible taper above the separate base into which it fitted; the second was similar but had a very pronounced and rather ugly taper and the third was a cast-iron one-piece chimney with an amount of taper that was a sort of compromise between the other two.

This last, in spite of the inherent plainness and austerity of its design, was a real work of art—there was some subtle quality about it that lifted it right out of the commonplace and turned it into a masterpiece.

This may possibly account for my personal aversion to the Drummond chimney being substituted for the Adams stove-pipe. On the other hand I have met many people who solemnly declare that the substitution actually *improved* the look of an Adams engine. There is no accounting for taste !

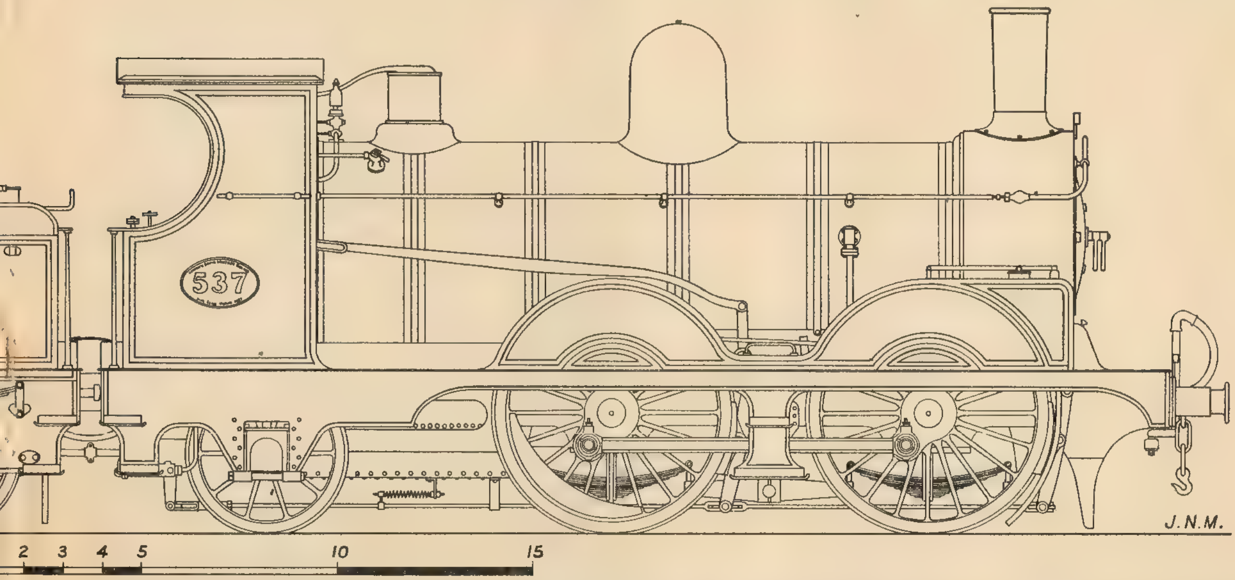
Unless my imagination was playing me tricks, I formed the impression in later years that the earlier engines of this class were rather livelier than the later ones. Whether this apparent difference was due to the change that Adams made in the arrangement of the steam-chests and valve-gears, I would hesitate to say; but it might be possible, because the original arrangement with the steam-chest underneath the cylinders would provide a less cramped space for the valves to work in than when the steam-chest was between the cylinders.

In addition, the fact that the earlier engines had screw reversing-gear instead of the lever would permit of much finer adjustment being made when notching up—and that might well result in a livelier performance from the engine. This kind of thing was ever an intriguing feature of the study of locomotive design; a slight alteration in the dimensions or arrangement of some particular part of the machinery would sometimes make a great, and even unexpected, difference to the performance of the engine.

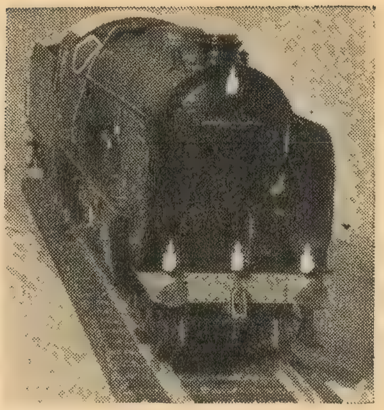
I have never been able to find out the details of the valve events on the Adams Jubilees. They must have been good, however, judging by the power these engines could develop on occasions, and the speeds at which they could run.

The first 20 engines of this class were equipped with the automatic vacuum brake complete; all the others had a steam brake and an ejector for working the vacuum brake on trains. Nos 529, 534, 538, 543, 555 and 556 were fitted with the Westinghouse air brake in addition to the standard brakes, and, therefore, could be used when required for working Westinghouse-fitted stock from other railways.

Finally, it is worth mentioning that No 654, completed in April 1895, was never altered in any way except for her paintwork; she was still in her original state, Adams chimney and all, when withdrawn in 1947, aged 52. ■



A $3\frac{1}{2}$ in. gauge SOUTHERN SCHOOLS



Presenting Louisa . . . an excellent example of miniature locomotive building, commends L.B.S.C.

As the direct route between London and Hastings via Tonbridge is due to undergo what our American friends call "dieselisation," the reproduced pictures of Mr R. P. Holdstock's $3\frac{1}{2}$ in. gauge Schools class locomotive *Louisa* should be especially interesting to readers who either live in the vicinity of that line or travel on it regularly.

This particular section of what was once one of the old South Eastern Railway's main routes between London and the coast has always been more or less a headache to the locomotive department. It branches off the main Dover line near Tonbridge, and right from the junction to St Leonards, where it joins the old L.B. and S.C.R. line from Polegate, it is just one continuous succession of curves and gradients, many of which are severe.

On top of that the tunnels are of smaller bore than those on the rest of the Southern system, which precludes the use of large and powerful locomotives such as would normally be used to run a fast service.

As an example, directly after leaving the junction with the Dover line—for which there is a severe speed restriction—the engine is faced with a six-mile bank. It starts at 1 in 53 and steepens to 1 in 47, after which it eases a little, the only level bit being between the platforms of Tunbridge Wells Central station, which is located between two tunnels like a station on the London Underground. Then the line "seesaws" from the southern end of Strawberry Hill Tunnel to Wadhurst, from whence it drops like the big dip in an old-fashioned switchback to a point between Etchingham and Robertsbridge. Then comes another stiff climb to Mountfield Tunnel, followed by more seesawing which eventually ends in a short drop to Bo-Peep Junction where the line from Polegate is joined.

To the best of my recollection there are only about four level stretches in the whole thirty-odd miles, none of them much longer than the length of a train; in fact the old Southern drivers said that whoever laid out the line ought to have put a few flights of stairs in it!

Special locomotives required

Previous to the grouping in 1923 when the S.E. and C.R. became part of the Southern system, the line was worked by the Stirling and Wainwright 4-4-0 engines with restricted loads, and the rolling stock used on the rest of the S.E. and C.R. was not too large for the small-bore tunnels. However, with the formation of the Southern Railway bigger and more comfortable coaches appeared. Some of these were arranged to clear the restricted loading-gauge of the Hastings line but that made little difference to their weight, and, as loads were increasing, the old engines were unable to keep time with them.

By then the King Arthur class of 4-6-0 had appeared; these engines were doing fine work on the rest of the system and could have handled the Hastings trains easily. But they wouldn't go through the tunnels—so what was to be done?

At that time Mr R. E. L. Maunsell was chief mechanical engineer. He had two very able assistants, Messrs H. Holcroft and J. Clayton, and what this trio didn't know about locomotives wasn't worth knowing.

They had already vastly improved the efficiency and performance of some of the older designs, notably the D and E classes of Wainwright design. And the biggest engines working on the Hastings line at the time of grouping were the Wainwright L class—the large 4-4-0s that appeared just before the start of the Kaiser's war. Incidentally, 10 of these were built by Borsig of Berlin and were shipped over partly dismantled. The German fitters had just erected the last one at Ashford when the fur began to fly. Some of this class were stationed at St Leonards, and as it was just about as much as they could do to squeeze through the tunnels without scraping any paint off, it was obvious that nothing larger in the way of a conventional 4-4-0 could be built, and the long wheelbase of a 4-6-0 wasn't exactly suited to the curves even if she could have negotiated the tunnels.

What was apparently needed was a compressed edition of a King Arthur which would not only clear the tunnels but go freely around what the children call the "johnny horners"—and that was the problem that faced the trio just mentioned. But they solved it! The result was Class V, commonly known as the Schools class because each engine bears the name of a well-known public school. They are of the 4-4-0 type with the maximum permissible weight on the coupled wheels; in fact when they first came out they were too heavy for some of the bridges on the Hastings line, and it was not until reinforcement was completed in July 1931 that they could go to work on the job for which they were primarily designed.

The restricted tunnel and platform clearance, which put large outside cylinders out of court, was overcome by using three cylinders, the two outside then coming just within the load-gauge limit. The big boiler has a round-topped firebox instead of a Belpaire, and this enables the sides of the cab to be canted inwards above the waist to clear the tunnel walls; the coping at the upper part of the tender side-sheets is similarly canted. Being superheated, with ample heating surface, a working pressure of 220 p.s.i. three $16\frac{1}{2}$ in. $\times$ 26 in. cylinders and 6 ft 7 in. coupled wheels, the Schools locomotives are the most powerful of the 4-4-0 type—not only in this country but the whole of Europe.

They were a success right from the start. And they have put up some very remarkable performances for their size and weight, not only on the London-Hastings route but on other parts of the Southern system, taking trains normally hauled by larger engines and easily keeping time with them.

A few minutes before writing these words one of them went past the back of our hacienda with the relief Newhaven boat train, which consisted of 11 coaches plus a four-wheeled van. She was trotting swiftly up the 1 in 264 grade as if it didn't exist, the exhaust being just a faint purring . . . not the slightest evidence of any effort. In fact, she was doing just as well as the much more powerful Milly-Amp locomotive which went past with the regular train shortly afterwards. If the much-vaunted multiple-unit diesel sets which are about to replace the Schools engines on the Hastings line can maintain the same standard of performance—well, good luck to them !

The Schools in 3½ in. gauge

For some 25 years I wrote a series of weekly locomotive-building articles for one of MODEL ENGINEER'S companion journals. When I had finished a serial, the editor sometimes took a kind of plebiscite of readers to see what they would like me to describe next—and one result was a big vote for a Southern Schools in 3½ in. gauge. I, therefore, got busy and schemed out a design for one, following my usual practice of incorporating all the characteristics of the full-size engine, but adapting her to suit 3½ in. gauge.

She had three cylinders and three separate sets of Walschaerts valve gear, the middle set being operated by a big eccentric by the side of the single inside crank. The boiler was of correct external dimensions and appearance, with my usual firebox, tube and superheater arrangement, and I utilised the crosshead-driven vacuum pump (later discarded in full size) for boiler-feeding, in conjunction with an injector. The specification included all the usual blobs and gadgets. All the full-size engines bore the names of boys' schools, but I didn't consider this quite fair; therefore, as the last of the big engines bore the number 939 and the name *Leatherhead*, I went one beyond that and called mine 940 *Roedean*, which, I afterwards heard, caused the headmistress much amusement.

There were a goodly number of little Schools engines built to the instructions, judging by the sales of castings and material and the letters and photographs that I received. However, a job like that takes a long time; only those who have actually undertaken it can appreciate how long it takes to complete the locomotive, when only a few spare hours per week are available and there are other calls on the builder's leisure. It was, therefore, no matter of surprise when I recently received a letter from Mr R. P. Holdstock saying that his Schools-type 3½ in. gauge engine had just been completed, and he was enclosing some photographs of it, several of which are reproduced.

The engine was built to specification and has turned out very well. Before final erection, the chassis was tested by air pressure, and proved satisfactory. The boiler, after a hydraulic test to 200 lb., had a steam test of ¾ hour duration after all the fittings were put on, and came through perfectly all right. I am now awaiting details of what she will do on a long continuous track.

It is only recently that British Railways decided to repaint the Schools engines in their original green colour. At first they painted them black. That didn't please Mr Holdstock at all—he was not the only displeased person, I might add !—so he painted his engine royal blue, with white and black lining, with red in the fluting of the connecting and coupling-rods, like the old Great Eastern. He also paid a graceful tribute to Mrs Holdstock by naming the engine after her.

As the pictures show, the locomotive is excellent in every way, and he certainly deserves congratulations. He says that his next engine will be a big type of 3½ in. gauge tank engine, and is rather inclined to have a go at building *Helen Long*, should I give any details of it.

An interesting variation

I mentioned earlier that the design of the Schools engines was influenced by the limitations of the loading-gauge of the Tonbridge-Hastings line, and quite a number of folk have speculated as to what the engine would have been like if built to the usual limits. Well, I can tell them, for I have here at the present minute some blueprints of the drawings made by Mr Holcroft of a "super-Schools." As Mr Holcroft was one of the designers of the engines as built, no one would know better what to do with the extra inches available.

He has called the enlarged edition *Richard Maunsell* in memory of his late and very-much-lamented chief, and she is certainly some engine. She has the three-cylinder arrangement, but the valve gear is unique. There isn't a locomotive engineer in the whole wide world who can beat Mr Holcroft in the matter of valve-gear design, especially where conjugations are concerned, and in this case he has schemed out an arrangement which has never before been presented.

The two outside piston-valves are operated by a variation of the Baker valve gear, which eliminates die-slip for the simple reason that there are no slotted expansion links and no die-blocks to slip in them. On some of the earlier American engines fitted with Baker valve gear, trouble was

LOUISA, *which Mr Holdstock named after his wife*

A $3\frac{1}{2}$ in. gauge
SOUTHERN SCHOOLS

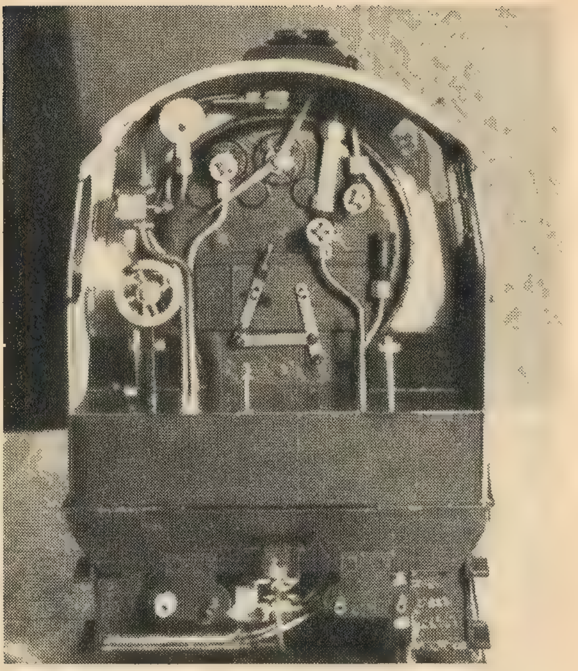
experienced with breakage of reverse yokes. In the Holcroft variation the reverse yokes are dispensed with altogether, and the radius bars are hung from blocks in a curved slide attached to the gear frame.

These blocks are stationary when the engine is running so there cannot be any wear, neither is there any risk of breakage. As the radius of the slide is equal to the radius of the end of the reverse yoke of the ordinary type of Baker gear, the accuracy of the valve setting is not affected, and is retained by the absence of the pins and bushes in a normal reverse yoke.

For operating the inside valve a simple conjugation is mounted on a small frame attached to the cross-stay, and driven by short shafts from the outside gears. This eliminates the long levers on the usual type of 2-to-1 gear as fitted to the Gresley Pacifics and other engines, and, with the short rods and arms, there is no whipping, nor overrunning of the inside valve. As the drive is taken direct from the outside gears, and not from the valve-spindles, a combination lever is fitted to the valve crosshead and the inside valve rod connected to it in the usual way—the same as the outside valve rod. Thus the three valves can be set correctly and will maintain their accuracy. Reversing is effected by a special type of wheel-and-screw.

The boiler is larger than the "standard" Schools boiler, with a Belpaire firebox similar to that fitted to the Lord Nelson class of four-cylinder 4-6-0s, and is arranged for a working pressure of 250 lb. The smokebox carries a double chimney, and there are two blastpipes. The coupled wheels are 6 ft 9 in. dia. with the usual type of connecting and coupling-rods. The sides of the cab are vertical, as well as the tender coping, and the whole outfit makes a fine-looking job. The originals were good-lookers as well as good-goers, but this one has just the "little bit of something that the others haven't got."

With the merging of the Southern Railway into the nationalisation scheme, the chances of a series of super-Schools locomotives being built faded away like a beautiful dream (worse luck !) but a small edition will be taking the road, and is even now in course of construction at Ashford. Roy Donaldson is building her in $3\frac{1}{2}$ in. gauge to Mr Holcroft's drawings.



Footplate view of LOUISA

The chassis is nearly finished at time of writing, and has been tested on compressed air. The Holcroft arrangement of valve gear works perfectly and, running with the wheels jacked up, turns evenly and maintains even beats almost to midgear. The boiler will have my usual arrangement of firebox, tubes and superheater.

No pictures have yet been taken, but Roy hopes shortly to get some done, including close-ups of the valve gear—so I hope shortly to illustrate something entirely new in the way of locomotive design and construction.

As a matter of both fact and interest the super-Schools was not the only Southern engine that was designed but never built. For instance there was a 4-8-0 intended especially for the Kent coal traffic. She was to have had the same cylinders and boiler as the Lord Nelson 4-6-0, and with 5 ft wheels would have shifted an enormous load—which was just the reason why she never eventuated. The passing loops and sidings were not long enough to accommodate such long trains. Then there was a Pacific intended for the Dover boat trains. She was, in effect, a Nelson class with a pair of trailing wheels added and a huge boiler with a wide firebox having about 40 sq. ft of grate area. To the best of my recollection the permanent-way department vetoed that one for bridge and other reasons, and it was never proceeded with after the track and bridges were brought up to date.

The success of the U and U1 class 2-6-0 engines prompted the idea of a 2-6-2 express passenger engine with the "works" of the U1 three-cylinder job, plus a trailing pony truck and a big boiler with a wide firebox. This would have also been a fast and powerful engine, but here again the big boiler and the extra accessories would have put more weight on the coupled wheels than the road would stand at the time, and so she never got beyond the drawing board—at least in full size, for I am building a similar engine in $3\frac{1}{2}$ in. gauge.

Referring to Postbag critics, may I remind Mr J. H. Balleny [April 18 issue] that the steam-raising fan referred to is not my design but a copy of the one presented to me by Mr Barltrop, as I distinctly stated when describing how to make it; and casing in the fan as he suggests will greatly reduce its efficiency. Most folk would prefer a power-driven fan to a hand-driven one, as both hands are left free to attend to the fire, and oil up or do any other job needed while "the kettle is boiling up." ■

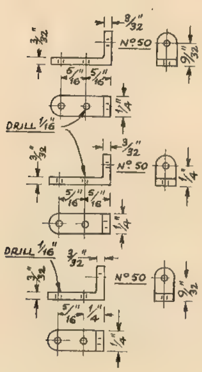
BELT DRIVES

Belt Drives in the Small Workshop by Duplex is a small useful book dealing with light transmission belts in all forms suitable for small power. It costs 3s. 6d. plus 3d. postage if ordered from the publishers, Percival Marshall and Co. Ltd, 19-20 Noel Street, London, W.1 (U.S.A. and Canada $1.00).

The ALLCHIN M.E. TRACTION ENGINE

The rivets, brackets, footboard and toolbox are among the items W. J. HUGHES deals with in this instalment

Continued from 18 April 1957, pages 562 to 565



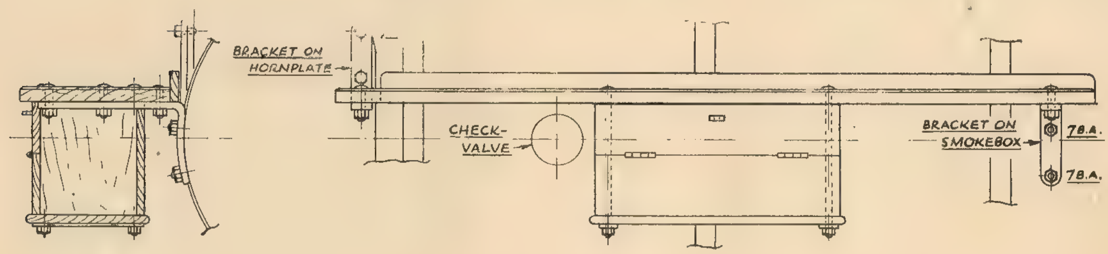
A FEATURE which will add greatly to the realistic appearance of both gearguards is the double row of rivets which, in big sister, fixed the plates to the angle-iron connecting them. On the model they are merely 1/32 in. round-head brass rivets, cut off so as not to protrude inside the casing, and sweated into holes drilled therein.

All the brackets (Figs 29 and 32) for both guards vary only in dimension; they are riveted to the guards with $\frac{1}{16}$ in. roundhead brass rivets. Tip for tyros: if you bend these out of 13-gauge material you will get a rounded corner which will not look right; I advocate using 10-gauge and then filing the surplus 1/32 in. from the outside faces (Fig. 33), which will leave a corner resembling that on the forged prototype.

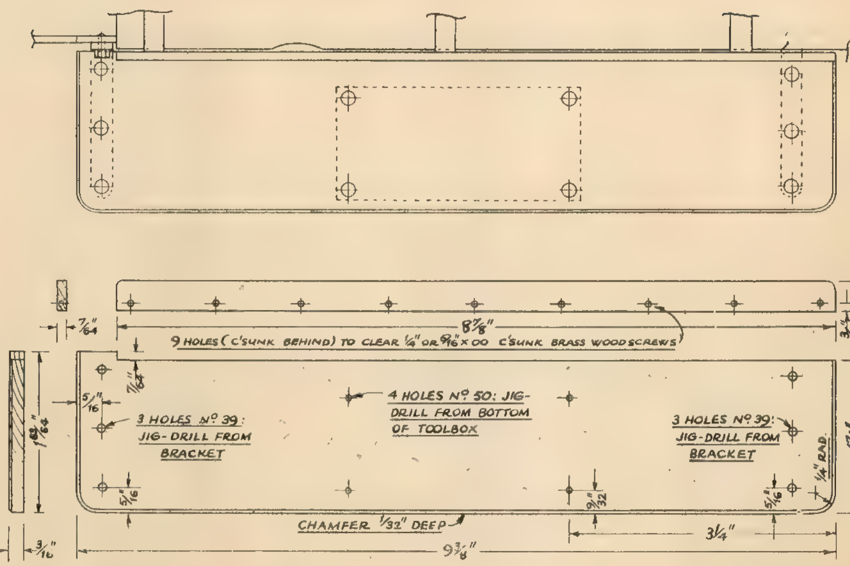
The brackets should be so placed on the guards as to line up with the existing holes in the hornplate. The rearmost bracket on the final drive guard is bolted to the tender side through a No 50 hole jig-drilled through that in the bracket itself.

FOOTBOARD AND KICKER

In many models I have seen—and especially ship models—a bad effect has been given by using unsuitable



Top, Fig. 32: Brackets for final drive guard



Right, Fig. 34: Arrangement of the footboard and toolbox with (below it) details of the footboard and the kicker

Below, Fig. 33: Making bracket corners square

timber with a pronounced grain or even figure. It should be borne in mind that even the grain of wood should appear to be "scaled down" in a model.

For this reason choose that for your Allchin footboard (Fig. 34) with

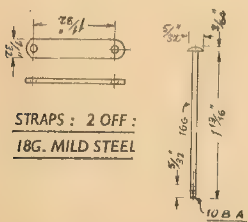
Left: *Fig*. 35: *The footboard bolts*

Right: *Fig*. 37: *Details of the hinges*

great care, as this will be finished bright—i.e., just varnished. The colour should be fairly light and the grain straight and very close. Plywood is *not* suitable, especially since the plies would show on the edges.

For those folk who find woodwork difficult (even though they are aces at metalwork !), metalworking methods can sometimes be substituted. For example, a fast-rotating endmill will "plane" end-grain nicely and remove the 7/64 in. strip at the back where the kicker fits. The corner can be rounded and chamfers worked by filing.

But whatever the methods used, do take time over the final rubbing down with glasspaper. All glasspapering should be done "the way of the grain" with the paper wrapped round a block—*not* with a sanding disc in the portable drill ! Final finish should be with nothing coarser than "spent" No 0 grade, and preferably finer than that.



Figs 38 *and* 39: *Straps for the toolbox and the toolbox bolts*

The kicker is secured to the footboard with $\frac{1}{4}$ in. or $\frac{5}{16}$ in. OO-gauge countersunk brass woodscrews, plus a spot of adhesive. For such small jobs I use one of the new PVA cements which dry fairly rapidly and are non-staining.

Six round-headed 7 B.A. bolts (Fig. 35) are required to fasten the board to its brackets, representing ordinary coach-bolts. These are best turned from the solid, though they could be fabricated as described later.

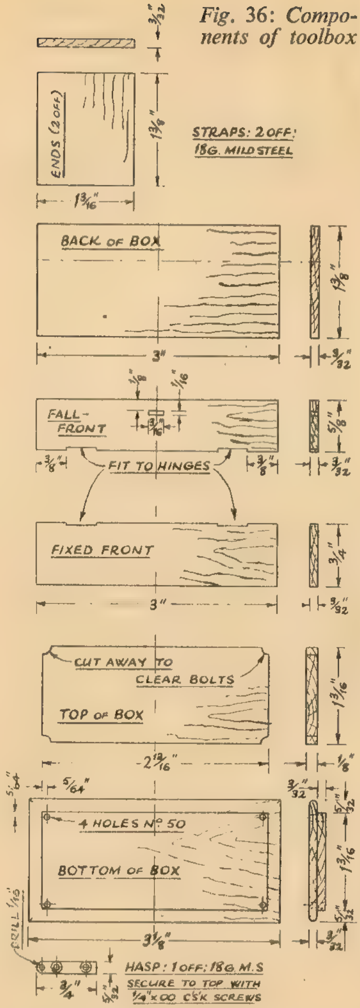


Fig. 36: *Components of toolbox*

The parts of the toolbox (Fig. 36) should also be made from close-grained wood, even though it is to be painted later. All joints are plain butt joints, glued and pinned, with the heads of the pins left proud of the surface. File them off flush when the cement is dry.

Making the hinges (Fig. 37) is a tricky little job, but if done in the manner described for those of the ash-pan they should present no great difficulty. It is advisable, of course, to make and fit them to the front parts

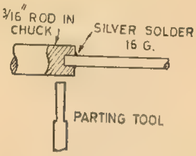


Fig. 40: *Method of fabricating the bolt-heads*

of the box *before* the latter is put together.

Use tiny pins to fix the hinges to the wood, then withdraw them. The pins may now be silver soldered to the hings and the heads filed off. In final assembly apply cement to hinges and wood, and push the pins into the holes in the wood.

The straps (Fig. 38) and hasp (Fig. 36) require no comment, but the long bolts (Fig. 39) may be a problem to turn from the solid, particularly in some lathes. However, they are not difficult to fabricate. Drill a hole $\frac{1}{16}$ in. dia. and $\frac{1}{16}$ in. deep in the end of a stub of $\frac{3}{16}$ in. rod, and silver solder a length of 16-gauge wire into the hole (Fig. 40). Part off $\frac{1}{16}$ in. of the rod, with wire attached, and it is a simple matter then to turn this to the correct shape.

At the present moment I have not completed the drawing of the padlock for the toolbox so I will describe this later.

To be continued

MOST POWERFUL LOCOMOTIVE IN GREAT BRITAIN

The Swiss-built gas-turbine locomotive, B.R. No 18000, is at work again in the Western Region after an absence of about two years. At the moment, it is on express passenger trains to and from Bristol. During its temporary retirement, some essential repairs have been made, following a mishap to some of its blading.

It has now been painted the standard locomotive green with a yellow band along the sides and ends of the casing. Its appearance has been very much improved, while its performance is, I hear, as good as ever.

But 18000 is not so powerful as the somewhat similar Metro-Vic machine, No 18100, which has been away at the maker's works for some time having the fuel supply system modified.

When this locomotive was at work in the Western Region from 1951 till 1954 it showed itself to be the most powerful locomotive in the British Isles. The calculated tractive effort of No 18100 is 60,000 lb., compared with 31,500 lb. for No 18000.

The work of these two machines has been such as to encourage further experiments with gas-turbines for railway motive power, and another very interesting example is likely to be at work before long.—J.N.M.

Do not forget the query coupon on the last page of this issue

READERS' QUERIES

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

Her livery

I have nearly completed a ¾ in. scale *Hielan' Lassie* and should be ready to start painting in about a week's time. Unfortunately, I do not possess details of the livery of this type of locomotive.—A.J.B., Widnes, Lancs.

▲ *It depends entirely upon the period you wish to represent in the locomotive. The prototype of this model is the Eastern Region's engine No* 60113 GREAT NORTHERN, *which is now classified A*1/1. *It is a rebuild of the original Gresley engine, formerly Class A*.10, *and when it was first rebuilt in* 1945 *it was painted entirely black. Subsequently, it was lined out with red lines.*

About 1949 *it was painted the then standard British Railways blue livery with black and white lining, but more recently this livery has been abandoned, and the engine is now in the standard British Railways green livery with black and orange lining.*

For a Britannia

I have recently purchased a Britannia 5 in. lathe and am now anxious to know what type and h.p. motor I will need to drive the machine satisfactorily.—S.P., Portsmouth.

▲ *A ½ h.p. motor would be sufficiently powerful for this lathe, but the type will depend on the supply available.*

For a.c. supply at 50 *cycles the standard form of split-phase induction motor running at* 1,400-1,450 *r.p.m. would be suitable so long as the motor is not stopped or started under load, and this is the type which is used most extensively for driving small lathes.*

Ideal wavemeter

I have built a model launch which I propose to control by radio. Can you give me any information on how to construct a simple absorption wavemeter to check the frequency of the transmitter—27 Mc/s ?—S.C.S., Llandudno.

▲ *Wavemeters set to* 27.1 *Mc/s, specifically for radio control purposes, are made by Flight Control, Romford Road, Manor Park, London, E.*12. *As a commercial unit the price must be kept down, resulting in an item which is less robust than one would make oneself, and which uses a bulb rather than the more sensitive meter as indicator.*

Wavemeters which cover the 27.1 *Mc/s band are also available for general amateur radio use and can be obtained from shops which cater for the "ham" radio enthusiast.*

An ideal wavemeter for model work was devised by the I.R.C.M.S. some years ago and pamphlets on its construction (together with a calibration service) are available from the I.R.C.M.S. pamphlet secretary, A. T. Sallis, 93 *North Road, Brighton, Sussex.*

Drive for drilling spindle

I have been making some of the attachments for the Myford ML7 as described in *In The Workshop*, vol. 3. So far I have made the dividing device, the leadscrew clutch, the saddle index, the back toolpost and now I am about to graduate the tailstock barrel. After this I intend to make the drilling spindle for the back toolpost and I was wondering if there was any alternative way of driving this other than by belt from an overhead shaft.

My lathe is a self-contained unit with the motor on its stand and I am particularly anxious to avoid fixing a motor on the wall of the room to drive the spindle. Would a flexible drive be suitable ? It would also seem that driving the spindle by a belt would produce further complications in the arrangement when the direction of drilling was altered, i.e., along the axis of the lathe and across it.—J.H.W., Billingshurst, Sussex.

▲ *It is agreed that the usual method of driving this type of rotary spindle from an overhead shaft often introduces diffiulties. It is, of course, possible to attach overhead gear to the lathe stand without the necessity of fixing it to the wall, and it can also be arranged to be driven from the lathe motor. But to avoid complications with belt drive, it is best to use a flexible shaft as you suggest; many readers have done this quite successfully.*

It would be necessary to use a flexible drive of fairly robust design, so as to be capable of transmitting sufficient power, and the type of drive employed for rotary files would be suitable.

An alternative method of drive is to mount a small motor directly on the spindle attachment to drive the spindle through suitable gearing. Some of the small low-voltage motors available on the surplus market are capable of producing considerable power and are sufficiently small in size to be suitable for fitting directly on the attachment. They can be driven from the mains through a transformer having suitable output voltage. A spindle with a motor drive of this type was described in MODEL ENGINEER *of* 2 *September* 1954.

Engine for Gondia

I hope soon to build the steam tug *Gondia* and would like to know if the Warrior engine will be suitable and whether the boiler, burner, etc., will fit the hull.—D.H., Plymouth.

▲ *The Warrior engine would be quite suitable and it can be steamed satisfactorily with the M.E. water tube boiler and vaporising burner.*

An alternative type of boiler would be the Trident Mark II which was described in the 13 *May* 1954 *issue of* MODEL ENGINEER.

Clock conversion

I have in my possession two German clocks, usually referred to as "400-day clocks." They are quite old and, as seems to be common with this type of clock, when they get to a certain stage they stop—and nothing will make them go again. To overcome this trouble would it be possible to convert them to electric drive ?—O.R.S., Kettleburgh, Suffolk.

▲ *It would be quite practicable to convert your clocks to operate electrically though the details of the conversion would depend on the particular design of the clocks.*

In most cases, these clocks have a balance escapement on the "roasting jack" principle, having a fairly long oscillation period, and it would be necessary to arrange the electrically-driven pendulum to drive the escape wheel at the correct rate to record the time properly on a dial. This would probably have to be worked out.

Several articles on the construction of electric clocks—some of them of comparatively simple design—have been published in MODEL ENGINEER, *and this information is also contained in the Pervical Marshall handbook "Electric clocks and how to make them," price* 10*s.* 6*d.*

ERECTING and SETTING OUT

G. WOODCOCK irons out some problems met in lining-up components

IT IS HERE proposed to deal with instances in which little or no datum face is available when erecting a machine, dealing first with a problem which covers the setting out of a workshop line-shaft and the relation to it of the motor.

Assume the shaft to be located from a wall, then if we presume a lean-to building against the flank of a house, this wall may form the datum for setting out the shaft in its horizontal plane. The shafting, unless very short, will be supported by cross-members which will be located in the flank wall by cutting out bricks, or by corbels.

These cross-members may be set roughly in line by checking with a tape from the ends of the building, lining up their upper surfaces (which will form the bearing faces for the journals) by means of a straight edge and a bricklayer's level. For the final setting the shaft itself may be used as a straight edge, with the plummer blocks upon it and each packed upon its cross-bearer until the level applied to the shaft shows it to be true.

Locating the motor

Having located the shaft, the position of the power unit may be considered. It will be seen in the sketch that a suitable straight edge is applied to the driving pulley. From this straight edge drop two plumb lines, as near its ends as possible.

If the motor pulley is equal in width to that of the shaft pulley then a similar straight edge placed across its face to contact both plumb lines will give the location of the motor. If it is wider, then it should be moved upon the motor shaft by an amount equal to half this additional width, and the straight edge applied as before. When the motor is located the pulley may be moved upon its shaft this amount, to centralise it with the driving pulley.

Another example of setting for erection is known as the straining wire system. In this case the erection of a locomotive forms a good example.

The centres of motion are set out by wires strained along their supposed centres, such items as cylinders, motion and slide-bar brackets being lined up from these centres.

In the first instance the frames are set vertically in jacks, each jack screw having a notched head. These jacks, and with them, of course, the frames, are then adjusted until both frames are true by spirit level. Cross winding is checked from both buffer beams, and the whole frame checked again by measuring upon the diagonals as shown.

It is probable that the setting out of plate work for boilers, or other classes of model engineering, will most greatly interest the reader. Before embarking upon a concrete example perhaps I may make mention of a very simple but useful tool which may be used in work of this nature, and will save a great deal of time. It is a plater's traveller.

This comprises a wheel in a suitable handle, the wheel being marked off in halves, quarters, and eighths of an inch. As an alternative, it can be marked into tenths.

For the wheel a piece of brass or stainless steel is most suitable. A disc should be cut out and turned upon a mandrel from a central hole to a finished diameter of $3\frac{3}{16}$ in. This diameter is most suitable as it can be turned to size by careful use of a pair of callipers. This diameter will give a circumference to the wheel of 10 in., or to be exact 10.013 in., an error of slightly over one thou in each inch, which for work of this nature is of little importance.

It will be seen then that by the use of a changewheel of 100 teeth it will be possible to divide the traveller into tenths of an inch. These sizes are smaller than those given for normal plate and boilershop travellers, but bearing in mind the requirements of model engineers I think the sizes will be most suitable. The wheel when completed may be mounted upon a small handle as shown.

A point which may be mentioned is that if the edge or rim of the wheel is turned to a V-section it is possible to run the traveller in a heavy scribed line upon the plate, which is useful on curved or uneven work. The drawback is that the V-edge will soon wear and render the wheel size inaccurate.

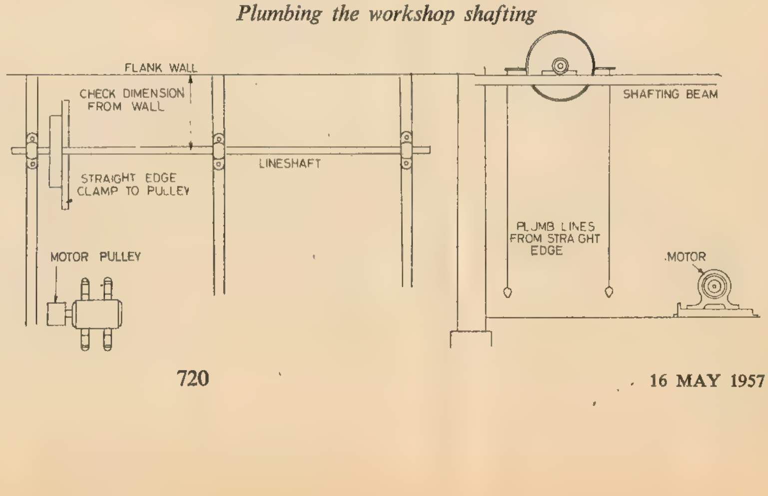
To give an instance of its use—take the setting-out of the plate required to roll the conical firebox of a small vertical boiler. The firebox ought to be conical for the following reasons. Firstly, water space is progressively increased from the foundation ring; secondly, the firebox is subject to external pressure but its conical form will increase its strength the higher it rises above the foundation ring. This is due to the reduction of diameter.

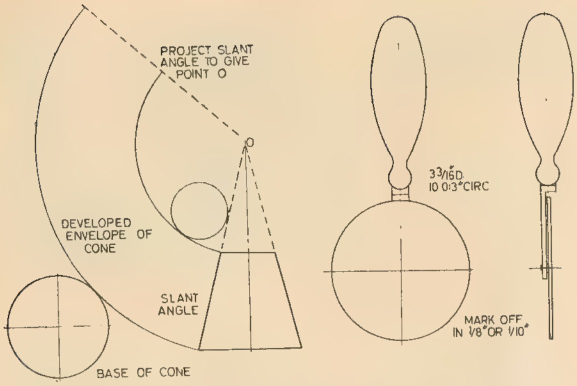
The finished firebox wrapper will assume the shape of the frustum of a cone having a distant apex. The builder will know what diameters he will require at top and bottom, and from this the slant angle will be known.

By projecting the slant angles to give the apex as shown at point *O* the envelope of the cone may be set out upon the sheet with a pair of trammels. Should the sheet not be large enough to permit finding point *O* then a strip may be tacked with solder to the main sheet upon which the apex may be struck.

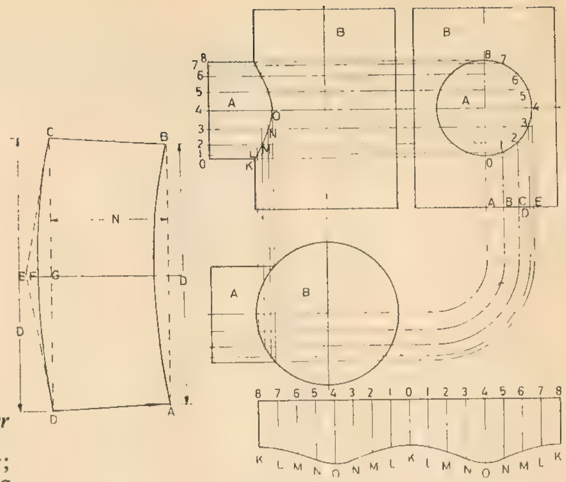
This being done the top and bottom

Plumbing the workshop shafting





Above: Setting-out development of the cone; the plater's traveller



Right: Setting-out conical shell plate having a distant apex; development of plate required for "A"; setting-out intersecting cylinders

diameters, or more correctly their circumferences, may be run off with the traveller to give the length of plate required to produce the cone, plus the lap if a lap joint is to be used. If a double-butt strap is fitted then the plate should be marked to the correct length only.

With the shell of a tapered boiler of a locomotive, due to the very small slant angle, the apex will be very distant, so it must be pointed out that a plate rolled to the shape to produce such a boiler shell would be described geometrically as the frustum of an oblique cone; that is to say the apex would not be central but off-set. For all practical purposes, unless the boiler was very large, it could be produced as a normal cone and the ends squared off as required afterwards to make it conform to an oblique cone.

Another method which is used in full-size practice, where the slant or taper is very small with a taper of say only 3 in. in 8 ft, makes use of neither triangulation nor trammels. It is roughly as follows. Set out the lines, *D* and *D*1, equal to the circumference of the large and small diameters of the boiler shell. On the lines, *AB* and *DC*, set out the distance, *H*, equal to the total length of the boiler shell.

To obtain the top and bottom curves draw two lines starting from the edges, *A* and *B*, and at right angles to the slant angles, *AB* and *DC*. These two lines will meet at a central point, *E*.

At a point, *F*, midway between *E* and *G* will be found the curvature required for the bottom edge. The curvature for the top edge or smaller diameter may be plotted or otherwise produced from this line.

One final example may be given. This is the matter of finding the line of the intersection of two cylinders.

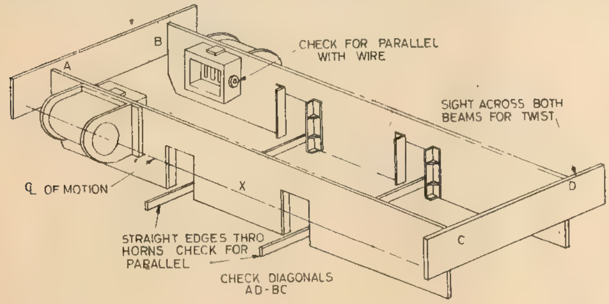
Shown are three views of a smaller cylinder intersecting a larger. Divide the semi-circumference of the smaller cylinder into any suitable number of equal parts. I have used 0 to 8. Through these draw vertical lines *Oa*, *Ib*, as shown. Also draw horizontals as shown. In the end view set-off lines, *FG*, equal to *AB* in plan. The line, *GH*, equals *BC* and *HI* equals *CD*.

Through *G*, *H* and *I* draw horizontals cutting the curve of the larger cylinder, *B*, at *L*, *M* and *N*. The centre line will be seen to cut the curve at *K* and in the periphery at *O*.

From the end view raise vertical lines to the side elevation as *K*, *L*, *M*, *N* and *O*. (The line, *K*, will already exist.) These will intersect the horizontal in the side elevation. These lines will give the outline for the line of intersection for a quarter of the circumference. From this the development of a plate for such a cylinder will be as follows.

Draw a line 8 8 equal in length to the circumference required, and divide it into the same number of equal parts. Through these lines draw perpendiculars and on them mark off the distances from the side elevation, *A*.

The lengths of these lines taken on the verticals and four times will give the shape of the plate required to give the intersection upon the main cylinder or boiler shell. ■



Checking locomotive frames

A new French super liner

THE French line which built the ill-fated *Normandie* some years ago is to build a new super liner. She will be smaller than *Normandie*, being 984 ft long × 108 ft beam as compared with the 1,029 ft × 119 ft of her predecessor.

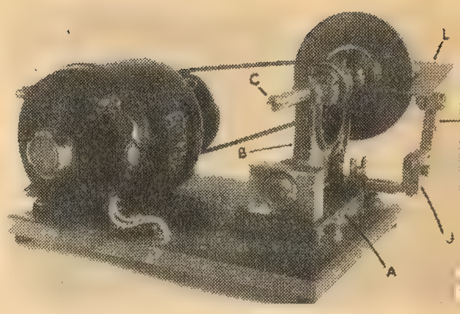
Her tonnage will be about 55,000, her speed 30 knots and she will have two funnels—otherwise her appearance will be similar to that of *Normandie*.

The possibility of nuclear propulsion is under consideration and, in the event of its being adopted in the next decade or so, her boilers will be arranged to facilitate their easy removal.

In addition, special precautions are to be taken against fire.

EXPERT'S WORKSHOP

A simple grinding machine for lathe work — By Duplex



ORIGINALLY constructed around the head casting of a disused drilling machine, the simple grinding machine (Fig. 1) has been modified so that readers with a taste for patternmaking can construct a useful and workmanlike piece of equipment.

The machine was conceived as a single-ended grinder whose sole purpose was the rough grinding of tungsten carbide-tipped tools in the Duplex workshops. But those who feel they need a double-ended machine should have no difficulty in modifying it to their needs.

A glance at the general arrangement drawings (Figs 1 and 2) will show that the construction is very simple. The casting for the head, *B*, is mounted on the baseplate, *A*, the former being secured to the base by means of two steel angle brackets, *B*1 and *B*2. In addition, a tool rest of the type often advocated in this series of articles is secured to the base by means of studs and nuts. The tool rest, being made from bright mild steel, needs no casting. It comprises but three components, parts *J*, *K* and *L*. The spindle, *C*, which is lapped before assembly, runs in plain cast-iron bearings also lapped to a high finish before the machine is put together. A simple method of taking up spindle end-float is provided and the mounting for the grinding wheel itself has been made as simple as possible consistent with good engineering practice.

The original grinding machine is seen in Fig. 3 and it will be noticed that the modifications made to this design comprise, in the main, alterations to the mounting of the casting which supports the two main bearings. This mounting now consists of a pair of steel angle brackets that enclose the base of the casting, *B*, enabling it to be bolted upright upon the base, *A*.

THE BASE

The base (*A* Fig. 4) is the first component to be machined. This work is most easily carried out by mounting the work upon the lathe faceplate and facing the casting by a turning operation carried out with a tungsten carbide-tipped tool. Since both sides of the casting need machining, a pair of tooling holes are first drilled in the base so as to secure it to the faceplate bottom side outward.

When this part of the machining has been completed the part may be bolted to the faceplate by bolts passing through the feet, which must be marked off and drilled for the purpose, or by clamping the feet to the faceplate.

THE BEARING SUPPORT

The casting for the bearing support (Fig. 5) has now to be machined. The first operation is the facing of the two surfaces that form the abutments for the angle brackets. This work may be carried out by hand filing though those who possess shaping machines will use them to perform the work.

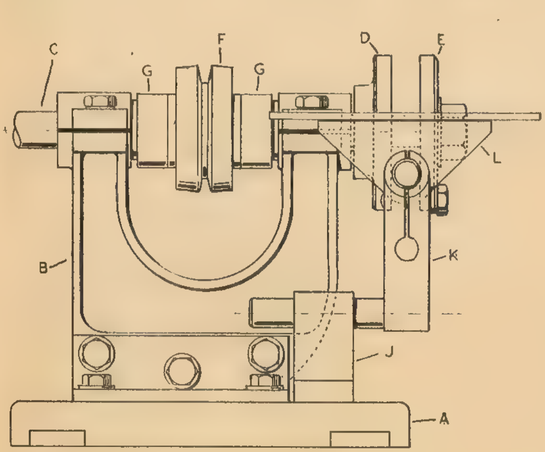
The machining must be accurate as these faces will be needed to mount the casting when boring for the bearings. Before machining, the work must be marked out so that the centres for the bearings can be aligned in the lathe. The work can be packed up on the lathe cross-slide and secured for drilling and boring.

If the grinding spindle is to run smoothly and quietly the bearings must be lapped before the work is completed, so leave 0.001 in. of metal in the bore of the bearings to enable the lapping operation to be carried out satisfactorily.

THE SPINDLE

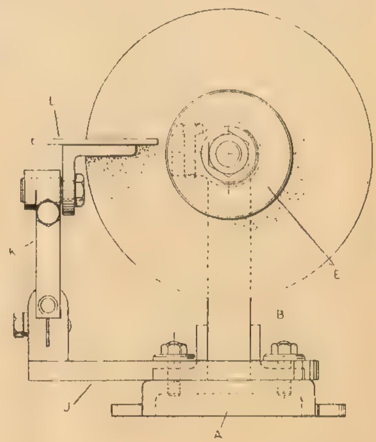
The spindle (*C* Fig. 6) is best turned from a piece of high-tensile steel; this work should be carried out between centres leaving the part approximately 0.001 in. oversize for lapping.

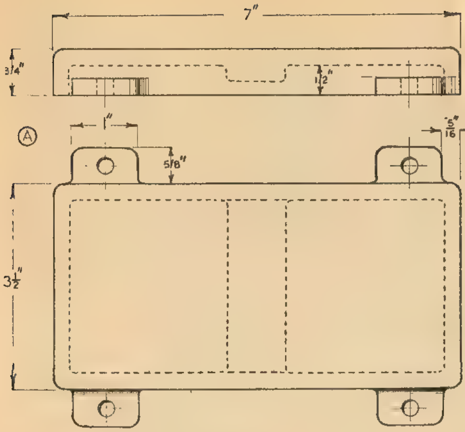
On no account should silver steel be employed. In the first place this material is of insufficient mechanical strength for the purpose; secondly,



Top. Fig. 3: The completed machine

Left and right, Figs 1 and 2: General arrangement





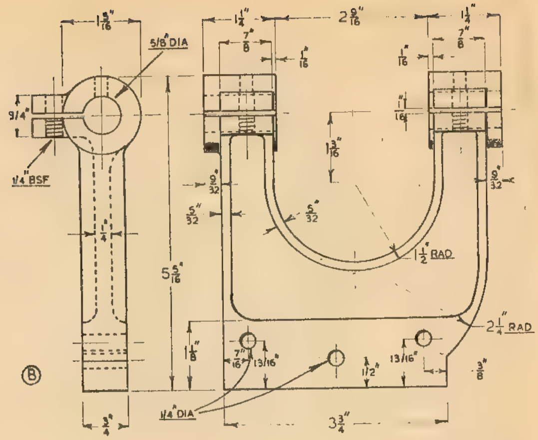


Fig. 4: *Details of the base*

Fig. 5: *The bearing support*

although as sold it *appears* to be round (the centreless-ground finish deceives the purchaser) silver-steel rod is often multi-sided and far from round. The statement sometimes made that silver steel is suitable for making spindles and that it can be employed "as received" without machining are unsound.

As to straightness, much of this material is ground to size in long lengths and is then cropped into the short pieces sold over the counter; what this shearing process does to the straightness of any individual length is anyone's guess. Of course, there is nothing to prevent the use of silver steel for making slow-speed and lightly stressed spindles. In such circumstances the defects in the material are not likely to have serious consequences.

I have always preferred to make spindles that are likely to be highly stressed from discarded or broken motor-car rear-axle half-shafts. The material from which these are made is easily machined and takes an excellent finish; moreover, its choice for such a highly-stressed part as a half-shaft is a guarantee of the high-tensile properties of the steel.

Any garage can provide material of this nature at little or no cost at all, so a small stock is well worth building up.

LAPPING THE SPINDLE

The spindle has been left 0.001 in. oversize for lapping, which is carried out by means of the single piece of equipment illustrated in Fig. 7. The lap consists of a piece of close-grained cast-iron made into a bush and turned to a size that will allow the lap to slip over the spindle. The lap is then split as seen in the illustration so that it can be made to grip the work by means of the holder, also shown; on no account should the lap grip the spindle tightly.

In use, the work is smeared with a non-charging lapping compound and the lap is moved up and down the work while it is revolving slowly. In this way all high spots will be removed from the spindle and the surface of the work will obtain a smooth matt grey finish. This is done in the lathe, care being taken to prevent the abrasive lapping compound from coming into contact with the ways of the lathe.

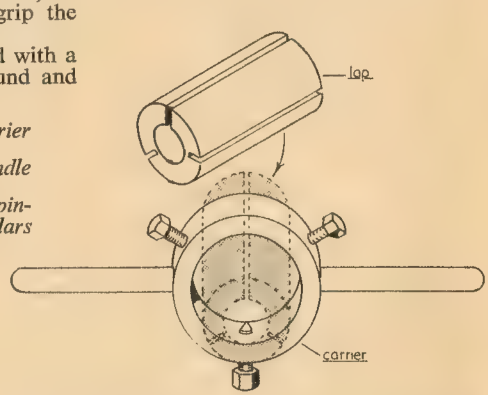
It will have been noticed from the illustrations that the spindle is provided with a Woodruff key. The methods used to machine the seating for the key, and even for making the key itself, have been the subject of earlier notes in this series of articles;

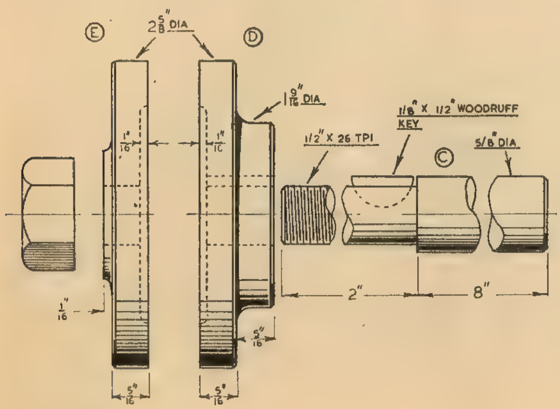
Continued on page 727

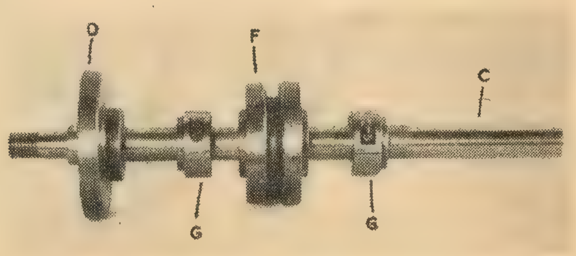
Right, Fig. 7: *Lap and carrier*

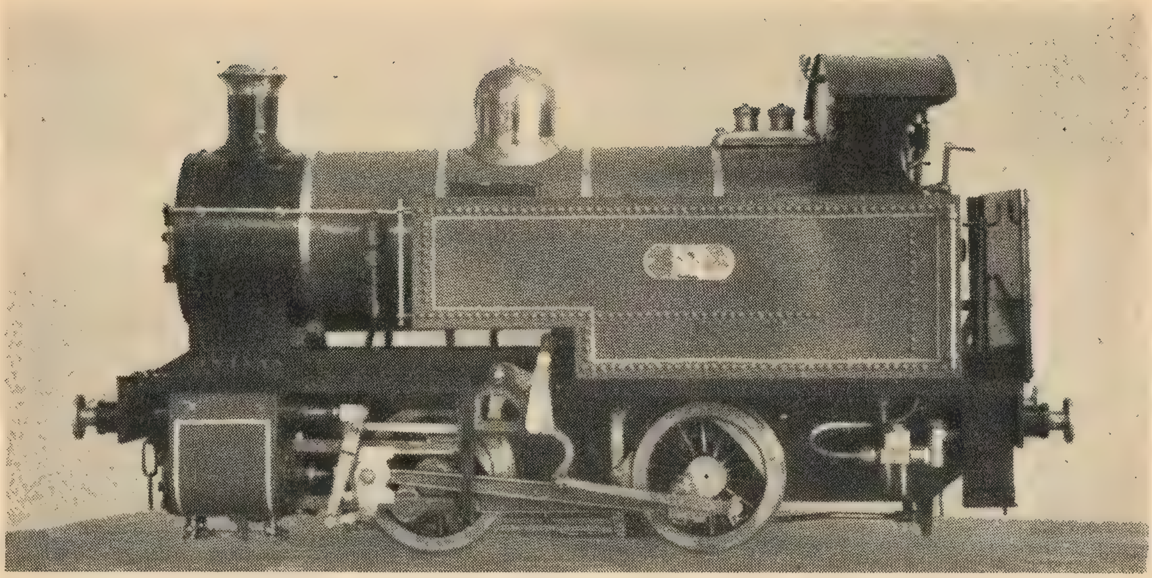
Below, left, Fig. 6: *The spindle*

Below, right, Fig. 8: *The spindle, pulley and location collars*









First attempts

And for one of these locos K. G. BAYLISS used a home-made lathe. Not bad for a beginner, eh?

For my first attempt at model engineering I decided on a $1\frac{3}{4}$ in. gauge 0-6-0 tank locomotive designed by Bonds o' Euston Road who also supplied blueprints and castings.

This locomotive which I named *Hazel* took about two-and-a-half years to build, using a home-made lathe. The boiler of 2 in. dia. has one $\frac{7}{16}$ in. superheater flue, six $\frac{1}{4}$ in. dia. fire tubes and three $\frac{3}{16}$ in. syphon tubes in the firebox. Firing is by a three-wick methylated spirit lamp with an automatic drip feed.

Cylinders are $\frac{1}{2}$ in. bore $\times$ $\frac{3}{4}$ in. stroke and the valve gear is slip eccentric. A displacement lubricator is in the left-hand tank and the boiler is kept supplied with water by an axle-driven pump. Working pressure is 60 lb.

Plain bushes only are fitted to the axles.

The frames, smokebox and cab top are painted black and the boiler, tanks and bunker B.R. green with red lining on the tanks. The buffer beams are red.

Dimensions are: length $12\frac{1}{2}$ in., height $5\frac{1}{4}$ in., width $3\frac{1}{2}$ in., weight in working order 10 lb.

This locomotive has proved very successful. The boiler makes plenty of steam and the engine is very fast and has good hauling power.

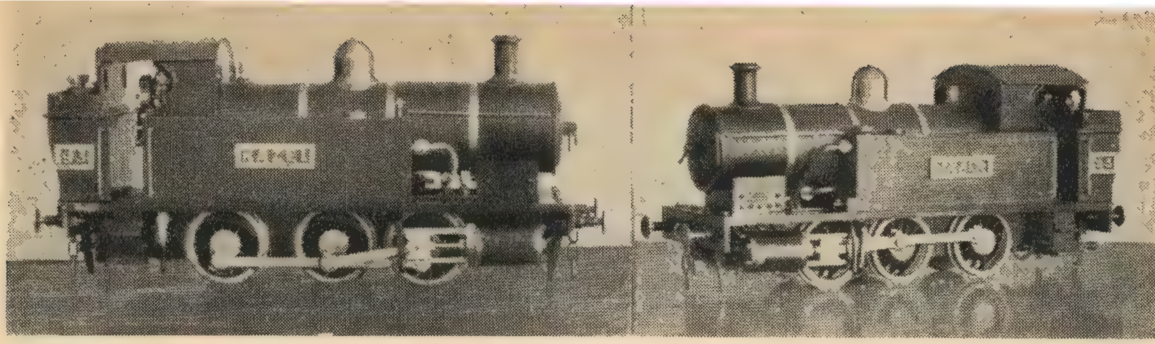
Encouraged by this effort I bought a Myford ML7 lathe and decided for my second attempt to have a go at *Juliet* No 2 with Baker valve-gear.

This was built to L.B.S.C.'s in-

Top: Something really ambitious! No 2, for $3\frac{1}{2}$ in. gauge, was built to the " words and music " for JULIET *No 2, and is a proper coal-fired job with Baker valve-gear*

★

Right: No 2 and HAZEL *compared for size, plainly showing the difference between $1\frac{3}{4}$ in. and $3\frac{1}{2}$ in. gauges*



Two views of the 1¾ *in. gauge* 0-6-0 *tank engine* HAZEL *which was the first of the two engines described to be built. It is spirit-fired, and the boiler is fed by an axle-driven pump*

structions. She has cylinder drain cocks operated from the cab, snifter valve inside the smokebox and brakes hand operated—also in the cab.

The plate at the rear is removable for ease of firing and the makers' nameplate just below can be swung to one side, disclosing a hole into which a key can be inserted to operate the blow-down valve.

The inside frames, coupling and connecting-rod flutes are painted signal red and the outside frames, wheels, smokebox, cab top and foot-plating black. The boiler, tanks and cylinder-lagging plates are green with yellow lining and the buffer beams are buffer-beam red.

Dimensions are: length 20½ in., height 10 in., width 7¼ in., weight 45 lb., working pressure 80 lb.

This locomotive has also functioned very well . . . she has pulled three adults on two cars with ease.

Building time: about two years.

My pictures show two views of *Hazel* and several of *Juliet*. There are also two of the engines together as it is interesting to compare their sizes, *Juliet* being built to twice the scale of *Hazel*.

At present I am building the Allchin 1½ in. scale traction engine and as a second string a ¾ in. scale G.W.R. Hall class locomotive. I hope to have the Allchin finished in about a year. ▣

C.A.V. apprentices do well in competition

FOR the second year in succession an apprentice of the C.A.V. Engineering School has won the Junior Challenge Shield awarded annually by the London Associaton of Engineers. The winner of this year's competition was an 18-year-old, W. Hambleton.

The contest, open to apprentices employed within a 25-mile radius of Westminster, attracted 60 entries. Contestants had to submit a work-piece of their own choosing, and a 1,000-word thesis on a subject of interest in the field of engineering science.

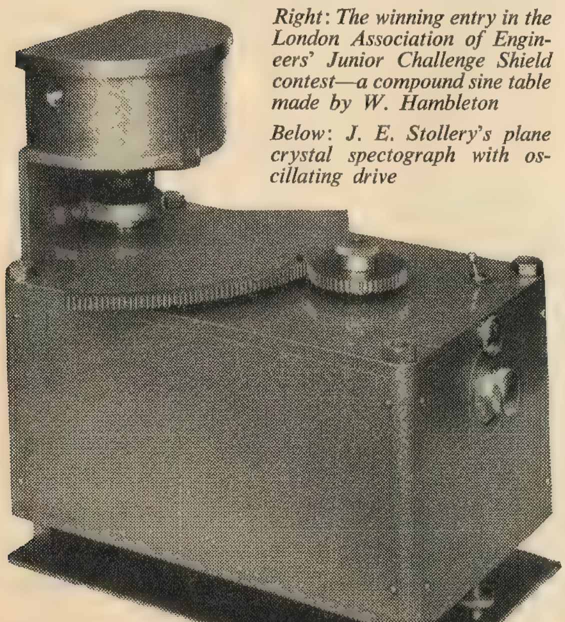
The winning entrant chose " Winding a strip-wound armature " as his thesis, and submitted a compound sine table as a work sample. The remarkable degree of precision which he achieved can be judged from the fact that the surface finish of the hand-lapped slip gauge face averaged 0.9 micro in., and that of the work face 1.7 micro in.

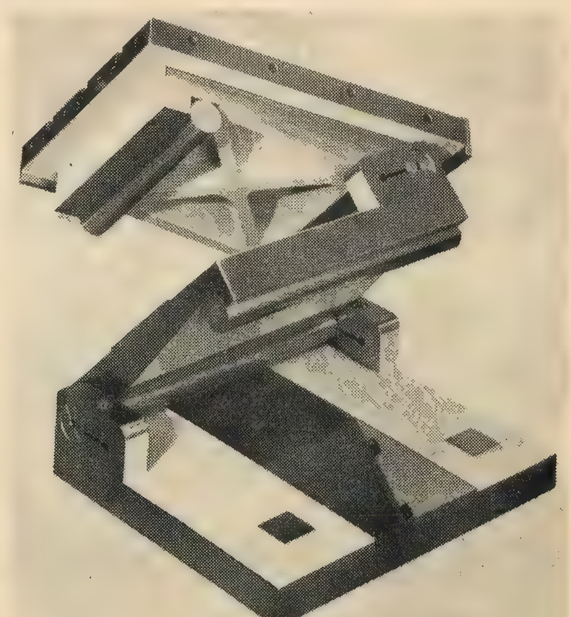
Another C.A.V. apprentice, J. E. Stollery, was awarded second place for his plane crystal spectograph with oscillating drive. This is a unique instrument which is to be used in the company's laboratories for basic research.

The third entrant from the C.A.V. School, J. S. Stevenson, aged 17, was placed sixth. ▣

Right: The winning entry in the London Association of Engineers' Junior Challenge Shield contest—a compound sine table made by W. Hambleton

Below: J. E. Stollery's plane crystal spectograph with oscillating drive





POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

PERSONALITY PICTURES

SIR,—I noted with interest the introduction of an article by S. A. Walter [Smoke Rings, April 25] which included a picture of the author himself.

I feel it would be rather nice if more of these photographs of the leading lights of our clan could be published together with their outstanding attainments and/or interests. One's imaginative conception of these nebulous bodies is often quite at variance with the real facts. Photos could also serve as a means of identifying celebrities on such occasions as exhibitions, rallies and the like, when one or two of these august personages usually make their appearance.

Let us hope that Mr Walter will be the first of a series which might be catalogued or collected by our readers, especially those with whom our personal interests lie.

North Wembley, Middx. — C. R. FOX.

ON SHOW

SIR,—I would like to inform all readers who are interested in the *Claud Hamilton* locomotive that the model referred to by Mrs Elenora Steel is at present on view at the transport exhibition at Euston station. As these exhibits are changed from time to time an early visit is advisable.

I have never seen one of these locomotives, but from what I have read about them I would say that the colour of this model is anything but correct !

Kingsbury, London, N.W.9. — D. A. SPROSON.

BLOWER

SIR,—Mr Balleny [Postbag, April 18] states that ex-Government blowers costing a few shillings are available on the surplus market.

Could anyone advise me where I could obtain one ?

Ilkley, Yorks. — JOHN H. SUMMERSGILL.

NO SEA IN M.E.

SIR,—As a shipmodeller and shiplover for some 25 years, I have resisted the temptation to appear in print in your publications until prompted to do so by the criticisms which other ship enthusiasts seem to be voicing at last.

I was a founder member of the pre-war Leeds Shiplovers' Association, and so speak with some experience and deep regret at the blow which has been dealt to enthusiasts like myself with the passing of *Ships and Ship Models*. I feel that we are not guests of, but interlopers in, MODEL ENGINEER and that we would be more at home in any other modelling publication of Percival Marshall and Co. than that in which we are receiving such scant attention at present.

The modelling articles, i.e., "St Ninian," "Myrmidon" and "U.S.S. Constitution," have all been of excellent standard but where is the true atmosphere of the sea ? Submerged, it seems, in machine-oil and steel shavings ! I have been trying desperately to find it in the past four months, along with the promised continuation of the regular features which, we were informed, would all be found in the revised publication.

It was such features as "Scrapbook," "Fleet Reviews" and "Mailboat" which provided the balance and contrast to the purely modelling aspect, and I doubt if we shall ever find the prosaic pages of MODEL ENGINEER enlivened by such a feature as "Master in Sail."

The present publication compares unfavourably even in the quality of printing paper, and, in the matter of pure economics, shipmodellers must pay no less than twice the former subscription for the all too brief privilege of keeping in touch with their hobby.

I have every copy of the former magazine, from issue No 1 in September 1931, and in comparing them with today's offering I am prompted to voice this protest, and to hope that an appeal to Edward Bowness, Jason, and others will restore the status lost on being "swallowed up" in January last. May I add that, until then, Percival Marshall and Co. lose one subscriber.

Bramhope, Leeds. — STANLEY KARFE.

WHAT IS IT ?

SIR,—Can any of your readers name the type of vehicle shown in my picture ? It seems that three men were required to manage it and that the seating arrangement was designed to give everybody as good a view as possible. What was the method of propulsion ?

The photograph was taken in Berlin in 1910.

Melbourne. — H. F. ATKINSON.

What is this unusual vehicle which reader H. F. Atkinson snapped in Germany nearly 50 years ago ?

MUNCASTER ENGINES

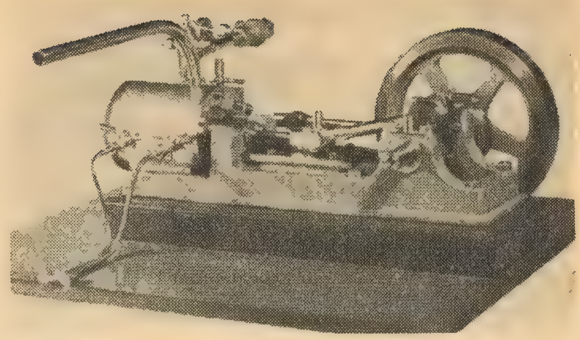
SIR,—I have been following with great interest the articles by Edgar T. Westbury on the Muncaster engines. On reading the fourth article, however, I was pleasantly surprised to find a description of a model which I have in my possession. It is, in fact, the engine shown in Fig. 24, page 489, April 4 issue.

When I acquired it, the engine had lain for a few years among some scrap in a local coal merchant's yard, the latter having bought it with a load of junk from a colliery which closed down some time ago in this district. Needless to say it was in a sorry condition.

I am at present carrying out a complete rebuild, and I enclose a photograph showing progress so far. The two vertical lugs on the bedplate referred to by E.T.W. can be plainly seen. I was quite baffled about their purpose until reading the article. A feed pump and mechanical lubricator are on the stocks at the moment.

I wish I could trace the original builder; possibly some keen old colliery engineman.

Brampton, Cumberland. GEO. R. TOWNS.



The model Muncaster engine which George R. Towns rescued from the junk heap

BALL-RACE WEAR

SIR,—I find that in a machine I am in the course of constructing a ball-race in a cast-aluminium housing has become loose, so that the whole ball-race now rotates with the shaft.

As this condition will probably worsen and put the bearings out of alignment, how do you suggest I repair this fault?

The housing has enlarged by only a very minute amount, so I think it hardly possible to include a shim between the ball-race and the casting.

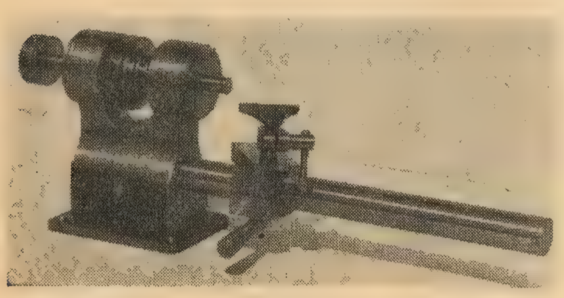
Kirkcaldy, Fife. GERARD I. KINGHAM.

BY BOYS AND GIRLS

SIR,—I have taken MODEL ENGINEER for many years. A good number of your designs have been put into practice in my school workshop over the past 10 years, by both boys and girls. I enclose a photograph of a simple watch lathe made by a 15-year-old boy (mostly done on an old round-bed Drummond lathe).

We also have an early Myford and an old 6 in. Master lathe which was picked up for £5.

Wetherby, Yorks. MARTIN EDEN.



This watchmaker's lathe was made by a 15-year-old boy. See Mr Eden's letter

L.B.S.C.'s NEXT

SIR,—Concerning the recent suggestions for L.B.S.C.'s next, I am all for a narrow-gauge type. How about one of C. E. Spooner's 0-6-4 Single Fairlie's of the Welsh Highland Railway? One never sees a model or even a photograph of these engines.

Moel Tryfan would make a handy size locomotive in 1¾ in. gauge and also in 1¼ in. gauge. May I also inquire if the reason is known why *Moel Tryfan* was cut up by the Festiniog Railway Society for it was the last example of this type of locomotive?

It should have been sent to the Narrow-Gauge Museum at Towyn.

Rhostyllen, Wrexham. J. S. JONES.

SIR,—What I would really like is a G.W.R. King in 3½ in. or 5 in. gauge; preferably the latter as I favour a ground-level line even if it means weight and a special tender for running.

But with such a noteworthy event as the return of the incomparable *City of Truro* could not your contributor be persuaded to describe that locomotive in 5 in., 3½ in. or both? Such a model would not be so heavy in 5 in. as the larger King and, since you seem to prefer alternatives, it might be possible for your contributor to give notes for the variations needed for a 38XX (renumbered) County.

(*Continued overleaf*)

EXPERT'S WORKSHOP . . .

Continued from page 723

there is no need, therefore, to go further into this matter.

When the spindle has been completed, the two plates, *D* and *E*, securing the grinding wheel may be made. The plate, *D*, has a key-way machined in it to engage the Woodruff key in the spindle. This key-way may be filed or machined in the lathe by setting an appropriate tool on its side in the toolpost at the correct centre height and then rocking the lathe saddle backwards and forwards while feeding the tool into the work. Do not attempt to take heavy cuts; 0.001 in. at a time is plenty.

As will be observed, both plates have their faces relieved so that they sit accurately against the sides of the grinding wheel when a pair of thin card discs is interposed between the plates and the wheel itself.

The plates should be made a good fit on the spindle; particularly the plate having a key-way. This part must be made a light press fit so that it can be fitted firmly against the shoulder formed on the spindle. When the plate is in position the spindle is mounted between centres and the contact face of the plate given a light facing cut to ensure that the wheel will run true when mounted.

As a matter of interest it should be noted that the diameter of wheel plates fitted to grinders should be approximately half the diameter of the wheel with which they are to be used.

● *To be continued*

POSTBAG . . .

If you should think that the G.W.R. has had too much attention (I know that that is impossible but I am not being rude but covering a hypothetical contingency), then I would like to suggest an L.N.W.R. locomotive—*Hardwicke*, *Jeanny Deans* or *Lady of the Lake*.

If 5 in. gauge has too few supporters I would like to ask for notes on the essential alterations (frame thickness, boiler-tube layout, etc.) to enable the 3½ in. gauge drawings to be scaled up.

London, W.3. WESTERNER.

SNOWDON LINE LIVERY

SIR,—In reply to M. K. Huggard's letter [Postbag, April 11] I visited the Snowdon railway last summer and I can say with reasonable certainty that the locomotives are painted either olive green or black, and the carriages are a dark shade of red, like that used by the Midland Railway.

Can anyone help me in my quest for blueprints of N.W.N.G. engines, especially *Moel Tryfan*? I intend to build a model of this in 16 mm. scale.

Birmingham, 20. B. A. WATT.

SIR,—In reply to M. K. Huggard [Postbag, April 11] about the livery of Snowdon engines, I saw one locomotive in light green and one in brown; neither was lined out. The coaches are painted in maroon.

I don't think much of W. Moultrie's letter. Journeys to the moon are of no interest to the model maker.

Ashford, Kent. C. E. CARTER.

BENZ CARBURETTORS

SIR,—Since writing my letter [Postbag, April 4] I have had an opportunity to examine the 1900 Benz which belongs to Mr R. Wilde of Leamington Spa.

In the carburettor fitted to this car the petrol level is regulated by a float mounted on a pivoted arm, similar in principle to the familiar arrangement used on water cisterns. It appears that as originally designed the flow of petrol was cut off by a flat plate which pressed down on the top of the orifice. Mr Wilde, when restoring the carburettor, altered this to a needle valve arrangement which should be more reliable.

I have made a sectional drawing of this carburettor from pencil sketches very kindly supplied by Mr Wilde. It is not to any particular scale, but I am satisfied that the various parts are shown approximately in their correct relative proportions and I have shown the petrol valve in its original form. The small darts indicate the passage of air through gauze-covered inlets, over the surface of the petrol, and through the cone-shaped flame guard to the engine. It will be seen that there is a separate exhaust-heated chamber at the base of the container to assist vaporisation of the fuel.

It is evident that this must be a later development of the carburettor described by Mr Westbury. Of what we may safely assume to be the earlier form Mr Wilde writes: "The type you mention is shown in many early books and, I believe, did exist because I have read contemporary accounts of drivers who said they had to turn on the petrol every few miles. The small twin Decauvilles have the same trouble, I know."

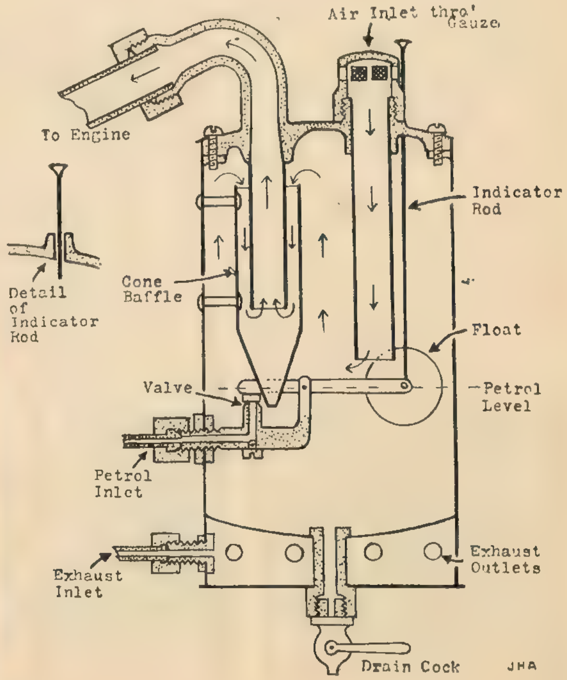
It will be noted that the carburettor illustrated has an indicator rod attached to the float and projecting through the top cover. It is not quite clear to me what purpose this rod served, except to indicate definitely if petrol was coming through or not. Possibly the explanation is that it was found to facilitate cold starting if the petrol level was raised, temporarily, by tickling the rod. Perhaps the practice of tickling the carburettor float chamber, very popular at one time, originated with instruments of this description.

Mr Wilde writes further: "Some early diagrams of the Benz carburettor show a most unlikely arrangement whereby the air has to actually bubble through the fuel. I cannot believe it ever worked because to create a sufficient depression in the inlet pipe to pull air through the fuel the inlet tract would have to be absolutely air tight. With a sloppy automatic inlet valve this is impossible, to say nothing of the mixing valve which admits additional air immediately before the mixture passes through the flame trap and into the cylinder."

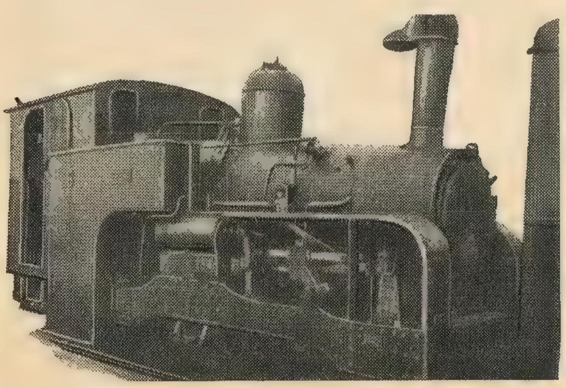
I have read references to these "bubblers" in early books so presumably something of the sort existed, but I must agree with Mr Wilde's reasoning. We should both be interested to know if carburettors of this type were ever a practicable proposition and how the disabilities he enumerates were overcome.

London, W.1. JOHN H. AHERN.

Right: Details of the early Benz carburettor. See the letter by Mr Ahern



Below: Mr Watt took this picture of one of the Snowdon locomotives



CLUB NEWS . . by Clubman

AMONG the M.R.C.'s own exhibits at the Model Railway Exhibition in London—the 32nd in the club's 47 years—was a kitchen-table workshop placed there to illustrate the kind of equipment which had been used to make the most of the excellent work on view.

The familiar all-purpose table—covered with the usual newspaper to prevent domestic complications—should have done much to correct the impression, common no doubt to thousands who visited the Central Hall, that modelling cannot be properly undertaken without elaborate tools.

As I mentioned in the issue of April 25, many people outside the movement are deterred from entering it by a feeling that their skill is inadequate. Linked with this misconception is a belief that the tools are always complicated—and, of course, expensive. The average adult visitor to the Model Railway Exhibition, had he been shown only the admirable workshop demonstrated by Chingford and District M.E.C., might have been confirmed in this error, and so it was an excellent idea, of value to the whole modelling movement, to make sure that the same visitor would not miss a display of more modest equipment.

Many clubs were represented, from the thirty-year-old Manchester M.R.S., the M.R.C.'s oldest friend, to such thriving youngsters as Chingford and District M.E.C., Epsom and Ewell M.R.C. and Nottingham M.R.C., all born in the 1950s.

Northolt, Leicester, Merseyside, Wimbledon, Ilford and West Essex, Folkestone and District, Epsom and Ewell, Hitchin and District, Orpington and District, and Croydon—all these clubs had something interesting to show. Needless to say there were contributions from S.M.E.E. [Smoke Rings, 9 May 1957], the Historical M.R.S., the Gauge 1 M.R.A., the Narrow Gauge and Light Railways Group, the Stephenson Locomotive Society, the Festiniog and the Talyllyn, and the Tramway and Light Railway Society. The British Transport Commission was of course very much there and its "Transport Treasures" from the larger exhibition at Euston Station were well worth seeing.

Add the G.W.R. 4 mm. Circle, the S Gauge M.R.S. and the N.M.T.A. British Region for those following American practice—add these and you will see that there was something for everyone at this crowded five-day show.

M.E. DIARY

May 16.—Festiniog R.S. Midland Group exhibition at Erdington (May 16-18).

May 17.—World Ship Society Merseyside branch annual meeting. Rochdale S.M.E.E., Lea Hall, 7.30 p.m.

May 18.—S.M.E.E. "Power Station Development," D. G. Webster, 14 Rochester Road, Victoria, London, 2.30 p.m. Festiniog London Group working party, Portmadoc (May 18 and 19). Bristol S.M.E.E. visit to Sudbrook Pumping Station.

May 19.—I.R.C.M.S. South London regatta, Brockwell Park, Herne Hill, 11.30 a.m. Worcester and District M.E.S. public running day, Waverley Street, Diglis (near main Bath road, Worcester), 11 a.m.

June 8.—Pennsylvania Live Steamers annual live steam meet, Kenneth Souser's Farm, Darby and Buttonwood Roads Paoli, Pennsylvania: $2\frac{1}{2}$ in., $3\frac{1}{2}$ in. and $4\frac{3}{4}$ in. gauges. All live steamers and their engines invited (June 8 and 9).

Model Engineer

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

Unrivalled In Its Class. The E.W. 2½″ × 10″ lathe. Model "A" plain lathe, £15 4s. Fully convertible to back gear and screwcutting. Illustrated leaflet. All accessories from stock. Lists, etc. S.A.E. Credit terms available, let us quote you.—Wanstead Supply Co., 30, The Broadway, Woodford Green, Essex.

Send for List of new tools at bargain prices. Drills, taps, dies, reamers, milling cutters, etc. Send s.a.e. to—A. King, 152, Halfway Street, Sidcup, Kent.

Wakefield 1⅝″ model makers' lathes, £8 10s. S.A.E. for leaflet.—Wakefield, 8, Adams Avenue, Tunstall, Stoke-on-Trent.

South Bend 4½″ bench lathe, motorised as new, £80, seen working Universal toolroom. 10 × 36″ miller motorised, seen working, £250.—Cable & General Instruments, 76, High Street, Beckenham, Kent. BEC 0389.

⅜″ High Speed sensitive power bench drilling machine, £6 10s. S.A.E. details. Credit terms available.—Wanstead Supply Co., 30, The Broadway, Woodford Green, Essex.

Disposal owing to death. Contents M.E. workshop. Part finished Allchin. Stuart Sandhurst. 0.22 rifle. Bargains. S.A.E. for list.—A. G. Mylward, Delhi, Lavington Lane, Littleton Pannel, Devizes.

For Sale. Flexispeed miller c/shaft, m/c vice, few cutters, arbor, etc. Better than new, £20 o.n.o.—J. Smith, 12, West Central Drive, Swinton, Lancs.

Heinmann 4½″ capstan lathe and ½ h.p. motor, complete with collets, £25.—Box No. 8517, Model Engineer Offices.

PORTABLE POWER HACKSAW MACHINES
Capacity 4″ bar. Complete, motorised for single phase supply, **£35.**
FLYCUTTING ATTACHMENTS
Clamp to lathe faceplate. Complete, post free, **10/-.** Cash with order.
Designed and produced by
R. H. FLETCHER
Crossways, W. Chiltington, Pulborough, Sussex

ML4 Bench Lathe and c/shaft mounted on pedestal, three chucks, faceplate, saw-table, tools, ¾ h.p. motor, £24. Drill on pillar, ⅜″, ½ h.p. motor, £6. Offers, must sell, moving.—365, New King's Road, London, S.W.6. Renown 3777.

Myford Super Seven with quick change gearbox, motorised on stand. Two screwed body chucks, fixed steady, adaptors for 8 mm. and ⅜″ collets. All in excellent condition, Hampshire area, offers. Enquiries—Box No. 8518, Model Engineer Offices.

New "Hoover" Motors in manufacturers' pack, ½ h.p. 400/440 volts, 3 phase, 50 cycles, 1,425 r.p.m., continuous rating, ball-bearing, foot mounting, ⅝″ shaft. Perfect condition. Cash price £6 7s. 6d. each, carriage paid, or £2 deposit and 6 monthly payments of 16s. Limited number only. Orders to—The Acorn Machine Tool Co. (1936) Ltd., 610-614, Chiswick High Road, W.4. (Telephone: CHIswick 3416.)

For Sale. Two plain lathes, new and unused. Cheap 3″ centres.—Box No. 8519, Model Engineer Offices.

6″ Stroke hand shaper, little used, £10. Would exchange for bench grinder. Wooden transporting case size 4′ 6″ × 1′ × 6″ fitted with 2½″ gauge track, £5.—Radford, 22, Sutherland Grove, S.W.13.

£9 Only. B.I.G. welding and cutting outfit, three torches, hose, regulators, gauges, etc., little used. Cost over £20.—Petter, 37, Parsons Green, Haslemere, Surrey.

⅜″ Bench Sensitive Pillar Drill, absolutely new condition, £6, carriage extra.—Mansell, The Jays, Glen Road, Oadby, Leicester.

Home-Master Workshop. All-in-one units, £14 10s. or £2 10s. deposit and 8 monthly payments of £1 15s. Will be sent carriage paid on receipt of deposit. (Money back guarantee if machine is returned within 7 days.) Write for/send orders to—The Acorn Machine Tool Co. (1936) Ltd., 610-614, Chiswick High Road, W.4. Telephone No. Chiswick 3416. Free 36-page booklet on application.

Sale. Wolf Cub outfit complete, new, less fretwork, planer and flex shaft set. Best offer over list price less one third.—Booker, Radwinter, Essex. Phone: 235.

10″ Bandsaw. 3½″ woodturning lathe, etc. Enquiries s.a.e.—T. Whitfield, 16, Hazelhurst Avenue, Beckfoot Lane, Bingley, Yorks.

Harrison 6″ Screwcutting Lathe. All geared head, good condition, £175. Toolpost grinder, microtest. As new, £35.—42b, Johnson Road, Bromley, Kent. Rav. 7413.

Adept 1⅝″ Lathe, complete with countershaft, 4-jaw chuck, precision drill chuck, tools, accessories, £7 10s.—Newman, 23, Beaulieu Close, Colindale, N.W.9.

Black Decker, Wolf accessories, secondhand. S.A.E. list.—Denny, 64, William Street, Long Eaton, Nottingham.

MODELS AND FITTINGS

For Sale. 7¼″ gauge steam Royal Scot, almost complete. Also 2½″ gauge steam Flying Scotsman, complete. Further details apply—Bartlett, 66, Bunkers Hill, Lincoln. Tel.: 1696.

£15 Hielan' Lassie, Olympiad, and other locomotives, boilers, tender, three parts finished.—2, Isabella Road, Homerton, London, E.9.

Wanted. 5″ Gauge locomotive, suitable tor passenger hauling. Photograph if possible.—Box No. 8513, Model Engineer Offices.

KENNION'S CATALOGUES
Tool and Materials 9d.
L.B.S.C. Blueprint & Castings. 1s.
Refunded on first 20/- order
3½″ G. Handrail Knobs
3s. 6d. dozen
OVERSEAS ORDERS A SPECIALITY
2 Railway Place, Hertford *Phone 2573*

30 c.c. 4 Cylinder w/c "Seal Major" petrol engine, complete with all electrics, and water pump, ready to fit in boat. Perfect running order, £35 or offers.—L. Cassanet, 19, Leander Road, London, S.W.2. Phone: TUL 1839.

Duke of Gloucester No. 71,000 4-6-2 B.R. tender locomotive in gauge "O." Booklet of building instructions with drawings and photographs, 5s., plus 4d. p.p. List 6d.—Luken's, 10, Coldbath Road, Birmingham 14.

Model Engineer

CLASSIFIED ADVERTISEMENTS

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- TRADE RATE 6d. A WORD
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M.E. QUERY COUPON MAY 1957

Frames for 7¼" Gauge practical tank locomotive cut to shape and drilled beams and plate fitted, £6.—26, Hog Hill Road, Romford.

5" Gauge 0-6-0 "Butch" chassis and finished parts. Also boiler parts and flanged plates. With drawings, Kennion design, £35. —41, Ventnor Street, Weddington, Nuneaton.

2-Stroke, 6 c.c. A.C. Stentor petrol engine, new.—22, Forest Rise, Kirby Muxloe, Leicester.

Twin Cylinder Blocks 2" × 3", crankshafts, etc., suitable 7¼" locomotives or 3" road engines. Also cylinders and parts for 10¼" locomotive.—ENGINEER, 92, St. Albans Road, Watford, Herts.

We Purchase good quality live steam locomotives, stationary engines, beam engines, traction engines, etc. Repairs and overhauls effected to locomotives from gauge 1 to 5" gauge. 3½" gauge weatherproofed sleepers, 18s. 6d. per 100.—CHERRY'S (SURREY) LTD., 62, Sheen Road, Richmond, Surrey. Telephone RIChmond 2454.

Wanted. Ship models, warships and merchant ships, scales 1" = 100' or smaller, any quantity, write and describe. Especially want models by Bassett-Lowke and Viking —offer £3 for Viking harbour set complete—also World War I indent, models by Boucher of New York. Naval Intelligence ship identification manuals, World War I or II. These editions only: Jane's "All the World's Aircraft," 1909, 1914, 1918, 1919; Weyer's "Flottentaschen buch," 1922, 1942/43; Clowe's "Naval Pocket-Book," 1914.—Below.

For Sale to Trade: Ship models, various scales—write for free list.—DON SCHROTH, Box 91, Blue Island, Illinois, U.S.A.

Princess Marina Chassis complete and all boiler material. Also 200 Model Engineers, £25.—BROWN, West Villa, Wistow, Selby.

Exchange — w.h.y., or sell air-cooled engines, need repair, two Douglas 450 c.c. One Coborn with 2" Winget pump, for details write.—The Willows, Woodcutters Avenue, Leigh-on-sea, Essex.

10¼" Gauge Locomotive, working order with approx. 200 yd. rail, £350.—Box No. 8522, MODEL ENGINEER Offices.

Complete Tender Wanted suibleta for 3½ 9 "Hielan' Lassie." Also 3½ 9 ball-bearing truck.—Box No. 8520, MODEL ENGINEER Offices.

ELECTRICAL

Electric Welding. Distributors and agents for ferrous electric arc welding sets to operate from domestic plug, first class job for heavy and model engineers, 190 to 240 volts complete with equipment and supply of rods, £23 10s. Delivery from stock, H.P. terms if required. Agents for three countries.—SAFFRON WALDEN ENGINEERING Co., Thaxted Road Works, Saffron Walden. Telephone 3397.

Accumulators, 2 Volt multiplate, 10s. each (uncharged), post extra. S.A.E. details.—WARD, 34, Livingstone Road, Bath.

A.C. Motors Self Start, induction, 200/250 volts, 50 cycles, 1 phase, 1,425 r.p.m., ¼ h.p., £4 2s. 6d., 1/3 h.p., £4 19s. 6d., ½ h.p., £6 15s. Perfect and guaranteed. Carriage extra.—JOHNSON ENGINEERING COMPANY, 319, Kennington Road, S.E.11. Reliance 1412/3.

Electric Motors, Brooks a.c. 3-phase 2 h.p., 415 volts, 3.25 amps. Continuous rating 1,420 r.p.m., 50 cycles with starter, £8 10s. Hoover a.c., 1-phase, 1/3 h.p., 200/210 volts, 3.0 amps. Continuous rating 1,425 r.p.m., 50 cycles, £4 10s.—HAROLD, 53, Oldridge Road, S.W.12.

SITUATIONS

Wanted. Turners, Millers, interesting work, small batches. Top rates paid. Liberal overtime. Small modern factory, easily accessible on bus routes 462, 215 and 715 Green Line.—BROOKLANDS ENGINEERING Co. LTD., Portsmouth Road, Cobham, Surrey, 3303. Rear of Cobham Motor Works, Ltd.

GENERAL

Learn It As You Do It—we provide practical equipment combined with instruction in radio, television electricity, mechanics, chemistry, photography, etc. Write for full details to—E.M.I. INSTITUTES, Dept. ME 47, London, W.4.

Spraying Handbook, 3s. 10d. post free. Paints, cellulose, all allied spraying sundries. Catalogue, 2½d.—LEONARD BROOKS, 25, Oak Road, Harold Wood, Romford.

Build Your Own Refrigerator. All components available at reasonable prices. Frigidaire units, £5. Single cylinder units, £4. New G.E.C. Coldair hermetically sealed and absorption units in stock. Hire purchase available. Heavy duty motors, 1/6th h.p. £2 10s. New chrome cabinet handle and hinges, £1 set. Money back guarantee. S.A.E. for list and schematic diagram.—WHEELHOUSE, 11/13, Bell Road, Hounslow. Phone: Hounslow 8749.

Guaranteed! Easy-Home Constructed Refrigeration. Genuine domestic components. Not secondhand ice cream scrap. Modern hermetic G.E.C. units, gas, electric and oil silent unit. Everything for refrigeration. Complete specialists. Send s.a.e. for free illustrated. "Sealed system" leaflet or 1s. for complete catalogue (refunded with first order).—BRAID BROS., 50, Birchwood Avenue, Hackbridge, Surrey. Phone: Wallington 9309.

For Sale. Carriage lamps for porches, single, all sizes and prices.—Box No. 8475, MODEL ENGINEER Offices.

Air Compressors, tanks and accessories at far below list, from £5 17s. 6d., TV and lighting generator from £15.—TEDDINGTON, ENGINEERING Co. LTD., 29-31, High Street, Teddington, Middx. Tel.: Kingston 1193.

Precision Engineers. Want ideas, patents bought.—Box No. 8399, MODEL ENGINEER Offices.

Watches, any make repaired (with guarantee) post confidently to—YOUNG & SON, 133, London Road, Chippenham, Wilts.

Villiers 147 c.c. fan-cooled engines, good condition, suitable for stationary work complete with carburettor and controls, ready to run, less silencer, £6 10s. each, carriage paid.—C. F. HEWERDINE, Thorpe Lea, Egham, Surrey. Phone Staines 3249.

Wanted. Urgently "Model Engineers" dated November 7, 21, 28, December 5, 12, 26, 1946, January 2, 23, February 6, March 13, April 3, 17, May 1, 15, 22, June 5, 19, 26, July 17, August 7, 28, September 18, 1947, containing articles on "Juliet."—WILLIAMSON, 53, Victoria Avenue, Wanganui, New Zealand.

Compressors for Sale. Two pistons complete with air receiver, driving wheel and motor cradle. 180 lb., 2½ cu. ft., price £3. Motors a.c. and d.c. all types ¼ h.p., £3. Carriage forward.—WHEELHOUSE, 13, Bell Road, Hounslow. Phone: Hounslow 8749.

Build Your Own Car Heater. Complete set of new components, £3, post 2s. 6d. Radiators 12s., post 2s. S.A.E. for list.—WHEELHOUSE, 13, Bell Road, Hounslow. 'Phone: HOU 8749.

Wanted. Steam water pump.—169, York Road, West Hartlepool.

Wanted. Vol. 1, 2, 3, 17, 37, 49, 59, 83. Bound or unbound.—Box No. 8503, MODEL ENGINEER Offices.

M.E.s 1944-54 clean, Vols. 100-103, bound, offers. Vertical boiler 10" dia., 6 cross-tubes, 50 p.s.i., unused, £5, plus carriage. Generator type P.2, 30 volt, 200 amps, unused, £4.—W. B. TYSON, 6, Holyoake Terrace, Beckermet, Cumbd.

Morris Commerical six cylinder, complete, dynamo starter, carburettor, reconditioned, unused five engines, £30 each o.n.o.—RALPH, Henley Common, Fernhurst, Haslemere, Surrey. Fernhurst 241.

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Model Engineer EXHIBITION

AN OUTSTANDING attraction at this year's " M.E." Exhibition will be the model diesel car racing layout. The North London Society of Model Engineers are supplying the track, and the Model Rail Car Association will be organising the demonstrations. The latter are inviting member clubs from all parts of the country to bring their cars and to be represented on the layout at various times during the Exhibition. Models of most of the prototypes will be on view, running at speeds of approximately 30 m.p.h. on the track—giving a scale speed of over 300 m.p.h. It is expected that there will be a demonstration for 15 minutes in every hour. Most of the leading suppliers have promised their support, and scale banners, hoardings, directional signs and other equipment are being provided. Twelve pits with scale fascias add their quota to the air of realism that is being aimed at.

AUG 21st—31st

NEW HORTICULTURAL HALL, WESTMINSTER LONDON, S.W.1